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Natalia Kyui

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Returns to Education and Education-Occupation Mismatch within a Transition Economy. Empirical Analysis for the Russian Federation.

Natalia Kyui *

* University Paris 1 Panthéon – Sorbonne, Centre d'Economie de la Sorbonne.
106-112 boulevard de l'Hôpital,
75647 Paris Cedex 13, France.

tel: (+33) 6 31 04 73 61, fax : (+33) 1 44 07 82 47
e-mail: natalia.kyui@univ-paris1.fr

Résumé

Le papier analyse dans un premier temps le rendement de l'éducation et l'appariement éducation-occupation dans une économie en transition. Puis, dans un second temps, l'article compare les caractéristiques du marché du travail russe avec celles d'un pays développé (ici la France). Les résultats montrent, par l'intermédiaire de l'exemple russe, que l'augmentation du rendement de l'éducation ne garantit pas que le fonctionnement des marchés du travail des pays en transition se rapproche de celui des pays développés. L'estimation standard du rendement de l'éducation est réalisée en considérant trois aspects du marché de travail: l'appariement éducation-occupation, le rendement des catégories socioprofessionnelles et la rémunération des différents niveaux de productivité au sein même des catégories socioprofessionnelles. Dans un premier temps, les estimations non-paramétriques des distributions des salaires en Russie et en France sont comparées. Puis, un modèle joint sous forme réduite est utilisé pour estimer les choix éducatifs, la participation au marché du travail, le choix des catégories socioprofessionnelles et des salaires. Ce modèle joint nous permet de prendre en compte les facteurs non observables qui influencent simultanément le choix d'éducation, le choix d'occupation et les salaires. Une grande variété de variables explicatives est utilisée, notamment celles qui caractérisent non seulement les individus, mais aussi leur famille, leur travail, les industries et les régions. Cela nous permet aussi d'analyser l'influence des réseaux familiaux sur le choix des catégories socioprofessionnelles et des salaires. L'hétérogénéité observable des rendements de l'éducation dans la population analysée est alors prise en compte. Les résultats montrent l'avantage de l'utilisation de la méthode proposée pour analyser les marchés du travail en transition.

Mots-Clés: rendement de l'éducation, choix des catégories socioprofessionnelles, économie en transition.
JEL: J24, J30, J31

Abstract

This paper makes a thorough analysis of the returns to tertiary education and education-occupation matches within a transition economy and compares these returns to similar returns in a developed economy. This study shows through the example of the Russian Federation that the increase in the returns to education which happened in previous years does not indicate that the labor market is becoming closer to that of developed countries. The standard estimation of the returns to education is deconstructed in three parts characterizing the labor market: education-occupation match, payment for occupations and payment for productivity within occupations. First, I compare the non-parametric estimation of wage distributions by educational and occupational groups within the Russian labor market and a developed country's labor market (I take France as an example). Second, I estimate a joint reduced-form model of the educational choice, labor market participation, placement of employees among occupational categories and wage formation. This joint model allows us to take into account correlations between unobservable factors that simultaneously influence the educational choice, occupational choice and final wage. A wide range of explanatory variables is used, characterizing not only individuals, but also their households, job, industries of work and regions. This allows us to analyze the influence of the family's network on the placements among occupational categories and wage formation. I take into account the observed heterogeneity of returns to education among the analyzed population. The results show the advantages of the proposed approach for the analysis of transition labor markets when compared with the standard approaches to transition economies.

Key Words: returns to education, occupational choice, transition economy.
JEL: J24, J30, J31

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1. Introduction

Recent economic literature on the returns to education during transition periods in Eastern Europe and ex-USSR countries provides evidence of significant increases in their rates.[1] Thus, for the Russian Federation, the rate of returns to a completed higher education degree relative to secondary education has increased from 12% in the Soviet period[2] [Gregory and Kohlhase (1988)] to 27-40% in the beginning of the 21st century [Nesterova and Sabirianova (1998), Belokonnaya (2007)]. At the same time, the significant mismatch in the correspondence between workers' education and their occupational categories in these transition economies remains the main feature of the labor market. This fact is well-reported for the Russian economy [Gimpelson et al. (2009), Denisova (2008)]. Although there is a growing body of literature on the question of the influence of the education-occupation mismatch[3] on wages for developed economies, no evidence of this influence for the Russian labor market or other emerging economies has been reported. The main interest in studying the role of education-occupation mismatch in wages is to distinguish the effects of occupation and education in wage formation. Considering the wider meaning of the term "returns to education", notably the possibility of finding a job, the quality or level of a job and a wage for this job conditional on education, we can obtain more information about the nature of returns to education within transition economies.

From economic theory, we know that education influences the possibility of finding a job as well as the level of this job within occupational categories. In that case, the education-occupation mismatch is not an exogenously imposed structure. Ignoring this fact in an analysis of the returns to education and using the occupational structure as exogenous in an estimation of the wage equation, which was usually the case in previous studies for the Russian Federation and other transition economies, could lead to inaccurate estimations, and, particularly, could bias the estimation of the returns to education.[4] However, the analysis of the returns to education, education-occupation mismatch and its influence on wages provide more detailed illustration of the labor market and could be certainly beneficial for government policy makers.

The current study provides a close examination of the education-occupation mismatch and wages for the Russian Federation. This work is the first attempt, to my knowledge, to estimate the returns to education with endogenous occupational choice for a transition economy. First, I compare the distributions of wages by educational and occupational groups within Russian and developed country's labor markets (I take France as an example) using nonparametric estimation. One could treat the revealed differences as the indicator of a still significantly prevailing influence of the past planning system on wage formation. Second, I propose and estimate a joint model of educational choice, labor market participation, distribution of employees among occupational categories and wage formation. This model allows us to take into account correlations between unobservable factors that

[1] Related studies are the followings: Svejnar (1998), Flanagan (1998), Rutkowski (2001), Keane and Prasad (2002), Cheidvasser S. and Benitez-Silva H. (2007).

[2] The Union of Soviet Socialist Republics (USSR), Soviet Union, was a constitutionally socialist state that existed in Eurasia from 1922 to 1991. In the current study, I refer to this time as the Soviet period. Studies conducted with the data for this period [Gregory and Kohlhase (1988), Katz (1999), Ofer and Vinokur (1992)] report different results on the returns to education, mainly due to the completely different population samples. I discuss below their findings in some detail.

[3] In economic literature, the term "education-occupation mismatch" refers to the disparities between workers' education and their occupational levels in the labor market. The correspondence between a worker's education and occupation can be analyzed with respect to different educational and occupational categories. For educational categories, economists look at the number of years of schooling, at educational levels obtained (high school, college degree, etc.), and at college majors. The scale of occupational categories and the levels of education-occupation match are generally defined according to the purpose of research and available datasets. I discuss this question in more detail in the following section related to the economic literature on education-occupation mismatch.

[4] In the section dedicated to the empirical modeling, I also discuss the persistent econometric problems in the estimation of the wage equation with occupational dummies.

simultaneously influence educational and occupational choices as well as final wages. In other words, the proposed approach allows us to control for the self-selection into occupational categories based on observable factors (such as education, tenure, experience, and family network) and unobservable factors (workers' abilities that are unobserved by economists). I estimate the returns to education and education-occupation match for male and female sub-populations, as well as for two age groups: 23-35 and 36-55 year-olds. I distinguish these two age groups in order to analyze the difference of wage formation between workers educated during the Soviet period and workers who made their decisions about tertiary education attainment after the beginning of the transition.

Like previous empirical studies for the Russian labor market, I report the positive and significant rates of the returns to tertiary education, which are higher for the female population. The current study challenges the hypothesis of the exogeneity of education-occupation correspondence. The results suggest that it is not only education that determines the distribution of workers among occupational categories, but also their social interactions (namely, occupational characteristics of other household members), professional characteristics (tenure) and situation in the labor market (regional unemployment rates for workers with different educational levels). At the same time, tertiary education is a crucial factor for obtaining a job in a higher occupational category, especially for the female population. Nevertheless, as it follows from the estimated model, expected wages might not be higher in higher occupational levels for the entire population. The returns to occupational categories depend on other characteristics, such as education, sex and age, and a correct match between education and occupation is especially important for university graduates. I also find a support of the hypothesis that it is necessary to control for unobserved characteristics that influence occupational choice and wages. Thus, the results of this study provide evidence of the importance of workers' negative self-selection into occupational categories nonmatching their education. From the results of estimation by age group, I can conclude that the returns to education as well as returns to occupational types are higher for younger workers. This fact might suggest changes in the mechanism of wage formation happening now in the labor market.

The paper is organized as follows. Section 2 presents a literature overview. Section 3 provides a brief description of the Russian labor market. Section 4 presents results of comparison of wage distributions for the Russian and French labor markets (with the focus on the influence of education-occupation mismatch on wages). Section 5 introduces the methodology of econometric analysis; Section 6 describes the data; Section 7 presents the results and Section 8 concludes.

2. Literature Overview

As mentioned previously, the analysis of the education-occupation mismatch, in particular, the question of the overeducation and its influence on wages, has already attracted much attention in the recent literature. Overeducation (Undereducation) is a situation when worker's occupation requires lower (higher) level of education than he has obtained. Overwhelming the majority of such studies has concentrated on developed economies. Their results [Rubb (2003-1), Hartog (2000), Budria (2008)] show the positive returns on overeducation within occupations that require lower levels, but these returns are less than in the case of working in an appropriate occupational type. In other words, overeducated workers (with higher educational levels than their occupational type requires) earn more than their colleagues with required level of schooling, but less than workers with the same level of education and correctly matched do. We can observe the inverse situation for undereducated workers:

they have higher wages than other individuals with the same level of schooling at lower occupational types, but lower wages comparing to their adequately educated work colleagues. This result holds regardless of how researchers determine required schooling for a job[5]. In the case of education-occupation mismatch in majors, workers who are mismatched earn lower wages than adequately matched workers do [Robust J. (2007), Nordin et al. (2008)]. Evidence of the long-term nature of the overeducation suggests that 80% of overeducated (mismatched) workers remain in the same occupational categories over years [Rubb (2003-2)], and the presence of mismatch penalties on wages within firms significantly affects career development [Groeneveld (2004)]. There are several reasons reported in the economic literature for the existence of overeducation. It may occur if employers use education as a mean of job screening in labor markets with imperfect information and due to asymmetric information problems [Spence (1973)]. Overeducation might also exist due to the employers' tendency to hire the better educated workers in order to save on training costs later [Thurow (1975)]; as well as because of the quality of the assignment of heterogeneous workers to heterogeneous jobs [Sattinger (1993)] and others. Thus, the presence of education-occupation mismatch may be evidence for inefficiencies in the labor market, and may be part of an efficient labor market where workers search for jobs throughout their career.

This question is still under investigation for countries with transition economies or for developing countries though the scale of mismatch could be more significant for them, and the contribution of education and occupation to wages formation could differ significantly from the developed economies [as an example of recent study for developing countries, see Quinn M.A., Rubb S. (2006)]. Two papers analyze to some extent the education-occupation mismatch for the Russian Federation. The studies of Denisova (2008) and Gimpelson et al. (2009) estimated the probability of working within less or more qualified professions conditional on education and educational majors. Though the paper of Denisova (2008) is not dedicated to the analysis of education-occupation mismatch (primary interest is the change in the returns to education during transition period and conditional on educational majors), it provides a brief analysis of the occupational choice by university graduates. According to their results, university graduates with economic, juridical, engineering and humanities majors are more likely to work on lower occupational levels not requiring higher education, comparing to university graduates with medical or pedagogical degrees. The author explains this fact by more favorable employment opportunities within medical or pedagogical occupations. However, the probability to work at a lower occupational level is explained only by educational majors, age and sex. Any of other variables that might potentially influence occupational choice were not included. Denisova (2008) also looks at difference in wages and controls for a work at a lower occupational level by using dummy variable (without any interactions with variables for majors), so assuming that the choice to work at a lower occupational category made by universities graduates is exogenous for a wage equation. Author reports that there is a return to higher education even within lower occupational category. No evidence is provided for the influence on wages of other educational levels or of education-occupation mismatch for workers without higher education; this work analyzes only education-occupation mismatch for university graduates. Gimpelson et al. (2009) analyzes the probability of working in lower or higher occupational categories or at the same level but not according to educational major. The authors provide a comprehensive and detailed review of occupational choices for workers with different educational levels and majors. They report that education-

[5] Some use subjective measures based on survey questions that ask respondents how much schooling is required for their job. Others use objective measures of required schooling at the occupation level, including a one standard deviation range around the mean level of schooling, the mode level of schooling, and estimates of required schooling provided by labor market experts. As it is pointed out by Hersch (1991): workers can be overqualified/underqualified in a number of ways, educational requirements are a common factor in most hiring decisions and are easily quantified.

occupation mismatch is important on the Russian labor market for workers with all educational levels. As in the current paper I do not focus on educational majors of workers I do not describe the findings of Gimpelson et al. (2009) in more detail. The main conclusion that we could derive from the presented here review of literature, that there is still no evidence of influence of education-occupation mismatch (for all educational levels) on wages in Russia, taking into account its endogenous nature. The current paper fills this gap.

In the recent economic literature on education-occupation mismatch huge debates have emerged around worker heterogeneity (and its influence on wages within occupational structure) and self-selection into educational and occupational choices. First, workers with identical educational levels do not necessarily provide the same productivity in general in the labor market and in a particular occupation, due to the following: personal abilities and skills (cognitive and non-cognitive), heterogeneity in educational processes among different schools and universities, and, finally, heterogeneity in education perception by students. Most of these factors are unobserved by economists.

Several papers estimate the influence of education-occupation match on wages taking into account worker heterogeneity. Korpi (2009) and Bauer (2002) have controlled for individual fixed effects and ability indicators. Obtained results are rather controversial: Korpi (2009) found that overeducated workers are penalized early on by an inferior rate of returns to education and this effect rests stable over the following time; in contrast, Bauer (2002) reports no difference between adequately and inadequately educated workers. Korpi (2009) also used an instrumental variables approach to control for the endogeneity of overeducation (they use related to childhood variables to control for difference in educational attainment). Another study [Dolton (2008)] controls for heterogeneity in the university education. McGuinness and Bennett (2007) use the quantile regression approach and analyze the returns to required education, overeducation and undereducation in different parts of the distribution of wages (using it as a proxy of abilities). The obtained results provide partial support for the hypothesis that overeducated workers tend to be low ability individuals. These studies focus on the heterogeneity of workers in their skills, but do not model occupational choices made by these heterogeneous workers.

The self-selection problem is also important in studying the influence of education-occupation mismatch on wages[6]. Workers make their choices (based on their knowledge, beliefs, and expectations) in educational attainment, employment and occupational attainment. Professional characteristic of workers (accumulated experience in the labor market) and social networks might also influence employment possibilities and occupational choices. That is why the placement of workers among occupational categories is not a random process, and when analyzing wages and returns to education one should not ignore its non-random origin[7]. The self-selection problem in educational attainment has been widely analyzed [see Belzil (2007) for a comprehensive review]. The question of the self-selection into occupational categories remains less investigated. Lee (1983) proposes generalized econometric models with selectivity involving multiple choices and censored dependent variables. One of the principal empirical papers on the occupational choices and returns to education is the paper of Keane and Wolpin (1997). This paper was the first to extend the self-selection mechanism for schooling choices, employment and occupational decisions. The authors estimate the consequential choices of

[6] A recent review of the literature on self-selection can be found in Belzil (2007).

[7] As it was underlined in Kean and Wolpin (1997) "As in the case of schooling and general work experience, comparing earnings of observationally equivalent individuals in different occupations will not provide an accurate assessment of the differential productivity of human capital investments among occupations because of the self-selection mechanism that drives occupational choice".

education and occupations (paper distinguishes three groups of occupations – blue-collar workers, white-collar workers and military services) in a structural framework, in the frame of the basic human capital model. Concerning rewards for occupational categories and returns to education within occupations, they obtained the following results. There is a positive significant return to the education within all occupational categories; furthermore, it is higher for white-collar workers (authors found a positive return to each year of schooling, and no additional returns for high school or college graduation). Other things being equal the white-collar occupations provide higher rewards than the blue-collar occupations[8]. However, the specification of the education variable as a number of years of schooling in their study does not allow us to analyze in more detail the influence of education-occupation mismatch on wages. For such an analysis it is necessary to specify not only occupational and educational variables, but also a rule for considering particular couple of an educational level and an occupational category as a correct match or as a situation with overeducated (undereducated) workers. Consequently, we need to estimate the rate of returns to education for all such combinations education-occupation.

Heckman and Sedlacek (1990) incorporated the self-selection correction for the sector of employment choices in analyzing the industrial wage premium. Neuman and Ziderman (1999) analyzed the influence of the vocational-education – occupation match on wages using switching regression models to take into account the problem of self-selection. Hotchkiss (1993) also used switching regression models to estimate the effect of training on wages controlling for the training-occupation match.

In the current study, I estimate the influence of the education-occupation mismatch on wages controlling for self-selection into occupational categories in the labor market (due to ability sorting). This allows us to separate education-related effects from effects of the type of occupation entered. I also look at the returns to education not only as the influence on wages but also as a risk of mismatch, as a probability to work in higher or lower occupational categories. The design of educational levels allows us to analyze the role of self-selection into occupational categories in the education-occupation mismatch and in its influence on wages. This study proposes a new instrument for the level of education obtained, based on the institutional features of the Russian educational system. Finally, this is the first known study for the Russian Federation, as well as for the countries with transition economies, which provides an analysis of the influence of self-selection into the labor market and of education-occupation mismatch on wages.

3. Russian Federation: Educational System & Labor Market

3.1. Overall Background

The transition of Russia to the market economy after almost 70 years of the Soviet Planning System has exerted a great influence on the labor market and consequently on the wage system. During the Soviet Union period, there was no competitive labor market. Government strictly defined and regulated the workers' allocation and the wage system. First, the government incurred all costs for education. Second, the labor force was distributed and allocated across industries and regions by the central planning system. Finally, the government determined the size of wages, including all tariff wage scales for each job category and regional wage coefficients. In high-priority sectors, like heavy industry and mining, rates for similar jobs were higher than in other sectors, and it is precisely this fact that

[8] Their results are used as the main benchmark in the current study, as a principal of the wage formation in the developed economies. I also confirm that these results are coherent with our stylized facts about French labor market.

explains the low rate of returns to education during this period in the Russian Federation. In reality, the Russian government artificially created a distortion in the wage system in favor of blue-collar workers, people mainly without higher education. One of the main purposes was to attract a new labor force to the military-industrial establishment or enterprises with poor working conditions. As a result, earnings poorly correlated with the workers' education. As soon as the Russian government released the strict regulation of the Russian labor market, the labor market started to become a competitive market for employees; the returns to education started to increase[9].

Empirical studies conducted for the Soviet period show that the returns to education were low. They also provide us with some evidence of the rewards for occupational categories. Nevertheless, the information we can find for the Soviet period is very limited. Gregory and Kohlhase (1988) estimated the returns to education within occupational groups (blue-collar and white-collar workers) based on the sample of migrants who moved to Israel[10]. Among the nine educational levels analyzed, the authors found positive and significant return to completed higher education for white-collar workers (12.79%-22.38%). They did not find any returns to any other types of tertiary education or levels within secondary education. For blue-collar workers, authors report insignificant returns to any post-secondary educational levels. Even if the influence of education-occupation match on wages was not a primary interest of their paper, we can still find some information from reported results. Their data report the following match between education and occupational levels: among white-collar workers 58.3% had higher education degrees, 31.4% had completed other post-secondary education; among blue-collar workers only 9.1% had higher education degrees, 59% - had post-secondary education. Accordingly, I can confirm a segregation of highly-educated workers into the higher occupational categories.

Keeping this in mind, let us look on difference in wages between these two occupational categories. Between white-collar and blue-collar workers, we cannot see any significant difference in terms of mean wages and standard deviations (mean wages reported are 165 rubles and 162 rubles by month correspondently, with slightly higher standard deviation for white-collar workers). However, authors do report that within white-collar occupations, there is a positive return to sub-categories of occupational groups (they analyzed occupational categories as exogenous to the wage equation); at the same time, this return is lower than the return to education within occupational categories. K.Katz (1999) reports some evidence on the returns to education and rewards for occupational categories for the sample of workers from one Russian city.[11] Katz confirms the positive return to higher education and vocational education but does not make a clear distinction between the effects of rewards for occupations and rewards for workers productivity (education). Nevertheless, the author argues that the blue-collar positions occupied by university graduates were the jobs that required the most qualifications, and were the most well paid jobs in the production field. Controlling for education, the author does not find any evidence of the different rewards within different occupational categories for the male population, and does find higher rewards for female university graduates within higher occupational types. There is also evidence that although individual educational attainment, particularly tertiary education, was the most important determinant of occupational attainment, parental cultural capital and personal social capital (including social networks) had significant direct influence [Wong (2002)]. We can also find some descriptive data on the education-occupation mismatch and rewards for

[9] See Gregory and Kohlhase (1988), Katz (1999), Ofer and Vinokur (1992), Nesterova and Sabirianova (1998), Cheidvasser S. and Benitez-Silva H. (2007) for other reviews of the labor market structure and educational system in the Soviet economy.

[10] While the selectivity problem is obvious in this study as well as in other studies conducted for the Soviet Union, the limited information on wages for this period does not provide us with more reliable and representative results. Nevertheless, it is not the purpose of the current study to overview and/or to give any opinions about problems with Soviet data. We just discuss their results in order to provide the reader with some brief information about wages before the period of transition.

[11] One more time we have a selectivity problem due to the dominance of heavy industry (strongly prioritized in the Soviet Union) in the analyzed region

occupation in the literature. Thus, Lopatin (2008) reports that the average wages for engineers' positions were lower than wages for workers positions, especially for young specialists, and the gap was increasing during Soviet period. Professors' wages (in secondary schools) counted for only 63% of average wages in industry [Rutkevich (2004)]. This distortion in within-occupations wages resulted in to the segregation of universities graduates to the low-skill occupations [Lopatin (2008)][12].

During the years of transition, the market faced a significant education/skills-occupation mismatch issue mainly for the following reasons:

i) The structural changes of the Russian economy led to the necessity of the re-qualification and re-specialization for a large part of the labor force. Some experience and educational skills were devaluated, specifically the skills related to military-industrial establishments, engineering industries and others.

ii) The growth of unemployment during the transition period and weak financial insurance for the unemployed part of the labor force also led to the unemployed population carrying out jobs that did not correspond to their educational or/and experience levels.

iii) The gap in wages between state and private economic sectors was increasing significantly during this period in favor of the private sector. This also led to the redistribution of the labor force between these sectors, which did not always correspond to personal skills or/and educational profiles.

That is why as a result we observe a significant distortion in the education–occupation structure: in other words, a huge percentage of the working population had to switch from their primary occupations to other working professions. Even today, there is still no balanced correspondence between the labor market and the educational system; these interactions are still in a period of adjustment.

Empirical studies based on the data of the current Russian labor market show an increase in the value of the returns to education and strong persistence of education-occupation mismatch. The work of Cheidvasser and Benitez-Silva (2007) provides an analysis of the returns to education in the Russian Federation for the years 1992-1999. Using a linear regression estimation of Mincer's equation, they show that the returns to education (to an additional year of schooling) is not higher than 5%, and there is no increase in returns during the analyzed period. Nesterova and Sabirianova (1998) estimate the returns to education in the Russian Federation in 1995. Using a linear regression estimation of Mincer's equation and Heckman selection model, they show that individual variation contributes the smallest portion of wage variance in Russia, and that wage variation is primarily due to two other factors: regional and firm differentials. Among individual factors, occupational dummies play a substantial role in earnings determination. In this work, occupation dummies were treated as exogenous variables. Kapelyushnikov (2006) provides a statistical analysis of the relationship between education and the labor market outcomes in Russia (in term of employment and wages) based on the annual statistical information of the Russian Federal Department of Statistics. According to these results, the premium in earnings of college graduates over earnings of high school graduates in Russia approaches 60—70 percent, so it is on the same order as in mature market economies. However, decreasing returns to skills for younger cohorts of Russian workers suggest that competitive advantages provided by high educational attainment might not be sustainable. Belokonnaya et al. (2007), by estimation of Mincer's equation, show that the return to higher education in 2005 is positive for both men and women, but more significant for female employees (40% and 27% in comparison with secondary education).

[12] As an example, Lopatin (2008) describes the situation in a workers' team at the Kuzbass coal factory (Kuznetsk Basin): among 11 miner workers, 7 had higher education degrees and 3 had with vocational degrees. Certainly we could not extend this example to all industries and economic sectors in Soviet Union.

Returns to incomplete higher education and post-secondary professional education are also positive and significant, but are much smaller than the returns to higher education. The difference in wages by types of occupation is also significant and varies between male and female populations. All the studies described above treated the distribution of workers among occupational types as exogenous. In the current paper, I have eliminated the assumption of exogeneity in order to take into account the observable and unobservable factors determining the education-occupation mismatch (controlling for the self-selection to different occupational categories), as well as to evaluate the returns to education, to overeducation and to undereducation.

In the next two subsections, I describe in more detail the educational and occupational systems in the Russian Federation and the evidence of current education-occupation mismatch.

3.2. Educational System

The Educational system in the Russian Federation consists of four levels: primary and general education (8 years at general schools); secondary education (2 years at general or specialized schools); tertiary (post-secondary) education; and post-higher education (3-6 years of graduate education). Tertiary education is presented by two levels (in the current study I also refer to them as the 1st and 2nd levels of tertiary education):

i) 1st level of tertiary education: post-secondary professional education, which consists of 2-3 years of study at technical schools or specialized schools (military, medical, musical).

ii) 2nd level of tertiary education: higher professional education: 4-6 years after secondary education at universities and colleges.

Table 1 shows the structure of the Russian population by educational levels (for the entire population and for the male and female populations older than 15 years) in 2002. As can be seen, almost a half of the Russian population has obtained the tertiary education degree. The female population has slightly higher tertiary education attendance than the male population.

People with tertiary education have higher employment rates and the lower rates of non-participation in the labor force. The employment rate for people with higher education in 2005 was 82%, for people with post-secondary professional education – 75.4% and for people with only secondary education – 52.9%. During the years 1998-2005, the employment rates for people with tertiary education increased and the employment rates for people with only secondary education decreased [Education in the Russian Federation. Statistical Yearbook. Moscow. 2007]. Therefore, tertiary education has a positive impact on the employment prospective, and its influence has become more important in the past years. The next sub-sections discuss the importance of education in the sorting to occupational categories and subsequent impact on wages.

3.3. System of Occupations

The International Standard Classification of Occupations is used to determine the structure of occupational levels and required skills (levels of education) for each occupation. Table 2 presents the structure of ISCO and correspondent ISCED levels of education required as well as equivalents in the Russian Labor Force Structure and in the Russian Educational System[13].

[13] The first skill level according to the ISCO schema includes the 1st ISCED category, comprising primary education, which generally begins at ages 5-7 years and lasts about 5 years. In the Russian education system, this category corresponds to incomplete secondary education. The second skill level includes 2nd and 3rd ISCED categories, comprising the first and second stages of secondary education. In the Russian education system, secondary education

I consider three aggregated occupational categories based on this occupational structure (with 10 occupational groups). The first occupational category – workers – includes 4th, 5th, 7th, 8th and 9th occupational groups listed in Table 2. The second occupational category – associate professionals – consists of the 3rd occupational group. Finally, the third occupational category – professionals and managers – comprises 1st and 2nd occupational groups. Table 3 describes the distribution of Russian employees among these occupational categories. For our further analysis, I do not take into consideration agricultural and fishery workers or the armed forces, primarily because of the low representation of these groups in our dataset and secondly, because of non-market wage formation and their very specific skill requirements.

Table 4 reports the employment rates within analyzed occupational categories by gender and educational levels: incomplete secondary education, secondary education, post-secondary professional education, incomplete higher education and complete higher education. The data are extracted from the RLMS 2005 year dataset, and describe the working population of 24-55 year-olds. We can see that the higher the level of education, the higher the employment rate. These employment rates values are comparable with the national statistics data described in the previous section. Table 4 also shows evidence of the education-occupation mismatch in the labor market: 44.5% of higher education graduates and 69.9% of workers with post-secondary professional education degrees work in the occupational categories with lower educational requirements.

3.4. Education-Occupation Mismatch

Table 4B depicts the educational qualifications of employees within occupational categories (for the entire 24-55-year-old population and separately for men and women). As can be seen in the table, within the 3rd occupational type, the majority of employees have the required level of higher education (66%) and post-secondary professional education (22.6%); within the 2nd occupational type the majority of employees also have higher education (35%) and post-secondary professional education (46.7%); within the 1st occupational type, the employees have post-secondary professional (52.1%) or secondary education (25%). It is notable that in the Russian labor market, we can observe a significant education-occupation mismatch going into two directions: the high share of overeducated workers in lower occupational categories and the presence of undereducated workers in higher occupational categories.

Data presented in this section suggest that education is not the only factor that determines the distribution across working occupations. Among other factors influencing this distribution, we can suppose that the following ones play a major role: personal skills and abilities, network relationships (receiving a job via parents' or friends' recommendations), searching techniques in the labor market, as well as others.

To what extent is this education-occupation mismatch important for the structure of wages?

Figure 4 illustrates the kernel density estimates (by using Epanechnikov kernel function) of the logarithm of wages for female and male populations, of working age (24-55 years old), depending on

begins at ages 6-7 years and lasts 10 years. The last two years of a secondary education could be replaced by 2 years studying in the establishments of primary professional education that also provide the degree of secondary education. The third skill level corresponds to the 5th ISCED category comprising education which begins at the age of 17 or 18, lasts about four years and leads to an award not equivalent to a first university degree. In the Russian Federation, the equivalent is the first level of tertiary education: post-secondary professional education. The fourth skill level corresponds to the 6th and 7th ISCED categories, comprising education that begins at the age of 17 or 18, lasts three-four years or more and leads to a university or postgraduate university degree or the equivalent. So the analogue in the Russian Federation is Higher Professional Education that provides a university degree after four-six years of study (four years – a bachelor degree, five years – a specialist degree, six years – a master's degree).

educational and occupational types. We clearly see that the density curve of wages shifts to the right with higher levels of education for the male as well as the female population. However, for the female population, this shift is more significant. Density curves by occupational types depict that for the female population, the curve for the 3rd occupational type shifts to the right compared to 1st and 2nd occupational types; for the male population, the curves for 2nd and 3rd types shift to the right compared to the 1st occupational type.

At the same time, for all four described in Figure 4 estimations, there are significant large areas of overlapping between wage distributions for workers with different educational levels or occupational categories. This means that the higher educational level itself or higher occupational category do not guarantee significantly higher wages for every person, though they provide higher rewards on average.

Why workers choose an occupational type that does not correspond to their educational level could be explained by the following reasons:

i) Personal skills, abilities, qualities, experience. During the selection process, an employer could check the candidate's skills. If a worker has a certain level of education but actually does not satisfy the skill requirements correspondent to this level of education, he may only be able to get a job with lower requirements. The inverse situation is also possible: a worker has a certain level of education, at the same time his personal skills, experience or/and tenure allow him to receive higher types of occupation in the classification because of his skills. The reason for this is widely discussed in the economic literature on education-occupation mismatch, overeducation and undereducation [Sloane et al. (1999), Robust J. (2007)].

ii) A personal (or household) relationship network allows higher occupational attainment [see Calvo-Armengol et al. (2005) for recent review of related literature]. In addition, one could have limited possibilities to search for a job – for example, a worker might accept the first proposition available due to the financial situation of his/her households.

Market inefficiency in wage formation for different occupational types. Thus, for a person with a certain level of education, it is more profitable to accept a job with lower skill requirements. This reason could be especially relevant for countries with transition economies, where the education system could not recover quickly from the economic structural changes.

4. The Russian Federation versus France: Occupational Placement and Wages

4.1. Scheme of Analysis

Before moving to comparison of Russian and French labor markets in terms of the relationship between education and wages, I briefly present the framework of such an analysis.

From the theoretical models on occupational choices[14] we could derive that an individual wage in an occupation is the product of the occupation-specific market rental price (equilibrium price) and the number of occupation-specific skill units possessed by the individual (for which the education, tenure and experience could be used as a proxy).

I suppose that all occupations in the labor market are divided into three groups by the correspondent level of required education. The labor market provides the payment for each occupation (the market rental price). Within a developed economy, the occupations requiring higher levels of education consequently get higher pay (Figure 1a) as they require higher productivity[15]. As I said

[14] For more details on the theoretical model one could see Roy (1951), Willis (1986), Keane and Wolpin (1997).

[15] I have discussed these findings in the section dedicated to the literature overview. For more details and for a data, one could see Keane and Wolpin (1997) as well as the literature on education-occupation mismatch reviewed before.

previously, during the Soviet Period in the Russian Federation, there was no significant difference in payments for occupations requiring different level of education (Figure 1b). As a consequence of this payment structure for occupations in a labor market, we can obtain the following payments by levels of education obtained: in the case of the USSR (Figure 2a), a developed country with no or insignificant education-occupation mismatch (Figure 2b), and for a developed country with significant education-occupation mismatch (Figure 2c). In the last case, the curves will be closer than in the first case for a developed country due to the loose correspondence between the levels of education obtained or productivity in the labor market and executed work[16].

Is the current situation in the Russian labor market close to the "USSR" labor market or to a developed country's labor market? Does the growth of the returns to tertiary education in the Russian Federation come from the changes of the market rent for correspondent occupations? And what is the role of the education-occupation mismatch in wage differentiation? The current section presents some empirical facts that could answer these questions, while subsequent sections will discuss the econometric model (as well as the results of its estimation) aimed to provide more detailed analysis.

4.2. Russia and France: Overall Background

To understand to what degree the labor market of an emerging country (in our case the Russian Federation) differs from a labor market of a developed country (I take France as an example), I make a short descriptive analysis focusing on characteristics relevant to this study: placement of workers among occupational categories and wages distribution among and within these categories.

For France, I use the data of the French Labor Force Survey, 2002. For Russia – the data of the Russian Longitudinal Monitoring Survey, 2005. For both countries, I take the data for the 24-55-year-old working population.

Overall, Table 5 reports that the level of education obtained by the Russian population is higher than by the French population. The biggest difference is the level of secondary education diplomas, more particularly the percentage of the population with a tertiary education. This fact might complicate the comparative analysis. However, I compare these two markets only visually, and in order to provide a brief overview of major differences in wage formation in the emerging and developed labor markets. That is why, I suppose that the significant difference in education obtained by the Russian and French population would not seriously affect the findings described below.

Table 6 and Table 7 indicate that the overall educational structure of employees in each occupational group is similar in both countries (taking into account that the level of education in Russia is higher than in France), especially for the female population.

4.3. Russia and France: Comparison of Wages Distribution

In this section, I present the analysis of wage distribution in the Russian Federation and in France (by kernel density approximation with Epanechnikov kernel function) for female and male populations of working age (24-55 years old) conditionally by educational and occupational types. However, I give only the main outlines of the role of education and occupational groups in wage formation.

Reported figures depict that in the French labor market the difference in wages is driven by the difference in payments among occupational groups. Education regulates the entrance into occupational groups, but within occupational groups, there is no significant difference between wages of workers with different educational levels. By contrast, in the Russian labor market, the difference in wages

[16] On the figures 1 and 2 I only present a conjecture of further analysis, which is not based on any real data.

among occupational groups is much less significant than in France, but education influences the productivity (and so the wages) within each occupational group.

Thus, we can describe the labor market of a **developed country (France)** with the following statements:

i) The labor market could be divided into occupational groups with certain requirements for productivity and corresponding payments for it. For a higher level of requirements, the wages are significantly higher.

ii) The labor market regulates the entrance of workers into each occupational group according to the correspondence of workers' productivity and requirements of occupational groups (education plays an important role here).

iii) The workers in certain occupational groups have mostly the same pay even with different levels of education (so the difference of education is compensated by other abilities of workers, such as skills, experience et etc.). That is why we could suppose the effectiveness of the distribution of workers to occupational groups according to their productivity.

iv) Rewards for occupational categories drive wage differentiation in the labor market.

The labor market of an **emerging country (the Russian Federation)** differs from the developed market I have just analyzed as follows:

i) The labor market could also be divided into occupational groups that require different levels of skills and knowledge from workers. However, the market payments for these different requirements have a less observable hierarchical structure compared to the developed market.

ii) The labor market also regulates the entrance of workers into each occupational group, and we can clearly see the role of education here.

iii) Nevertheless, education continues to influence wages positively within each occupational group, so the level of productivity is different within each occupational group, and these differences are not eliminated at the stage of workers' placement among occupational groups. However, the usage of aggregated occupational categories could also explain this fact.

iv) Rewards for different occupational categories do not differ as much as in the French labor market, even when I look at workers with the same educational levels.

Therefore, two problems with the labor market in the Russian Federation might be questioned. First, there is an ineffective allocation of workers among occupational types according to their productivity. In the case of the Russian Federation, this fact could follow from the system of skills developed earlier, which might be inappropriate to the current economy, from re-qualification and re-specialization of labor, force which was necessary during transition. It might also be a result of high unemployment rates during transition that influence workers' decisions during employment choices. In other words, there is a significant education-occupation mismatch. Second, there is no hierarchically structured remuneration system for different occupational types according to the required skills and productivity. In the case of the Russian Federation, this fact could follow from the previously existing planning system of wages that continues to impact the current labor market.

Results presented in this section might suggest that in spite of the increased returns to tertiary education in the Russian Federation during transition period, the current labor market is still closer to the Soviet System than to a developed country in terms of payments for occupations on the market. Nevertheless, the Russian market is potentially moving towards the labor market of a developed country. Still, there is a significant education-occupation mismatch in the market and the distribution of

workers among occupational categories is influenced to a large degree by other characteristics, not only by education.

In the next section, I analyze in more detail the difference in payments for education and occupational categories in the Russian labor market described above. I present the estimation of the returns to education and education-occupation match controlling for the endogenous distribution of workers among occupations.

5. Model: Methodology and Estimation

I estimate the wage equation beginning with the Mincer's equation and controlling for endogenous choice of education and occupation (self-selection into educational levels and occupational categories) and for self-selection into employment.

As the base of the econometric model I use the Mincer's approach to wage modeling [Mincer J. (1958,1974)]:

$$Ln(wage_i) = \beta_1 + \beta_2 \cdot Education_i + \beta_3 \cdot Experience_i + \beta_4 \cdot Experience_i^2 + \varepsilon_i \quad [1]$$

All previous studies for the Russian labor market used this equation with several additional sets of control variables and sometimes with control for sample selection bias (if data were available for both working and unemployed populations). Several studies for the Russian labor market took into account the occupational categories (by adding dummy variables for occupational groups into the wage equation) and provided us with the evidence that the occupational categories significantly influence individual wages:

$$Ln(wage_i) = X_{wage,i} \cdot \beta_{wage} + \beta_5 \cdot Dummies\_for\_Occupation_i + \varepsilon_i \quad [2]$$

In the case of a developed market, the occupational categories are ranked respectively to the required levels of productivity and are accordingly paid. The market mechanism places workers according to their productivities. In that case, the inclusion of such dummy variables makes no sense, because the distribution among occupational categories is strongly correlated with workers' productivities, hence with their educational levels and unobservable skills (actually, the inclusion of such dummy variables does not add any additional information to the results). For transition economies, the additional analysis of the influence of occupational dummies makes sense due to the following characteristics of transition economies:

i) Inefficiency of the labor market mechanism with regard to education-occupation match, in other words, the correspondence between workers' education and their occupational categories. Such distribution among occupational groups is not completely determined by workers' productivity/skills due to i) strong influence of family networks during the employment process, ii) imbalance between education and market requirements.

ii) Inefficiency of the labor market mechanism with regard to wage-by-occupation formation. The remunerations paid for occupational categories might not always correspond to the productivity of workers and productivity requirements within these categories due to i) influence of the previous Soviet planning system on remunerations in different occupational categories, ii) growing differences between wages in public and private sectors.

In order to understand to what extent these two "market inefficiencies" influence the returns to education and returns to education-occupation match, it is necessary to take into account the workers' distribution among occupational categories. Nevertheless, the assumption of the exogenous nature of this distribution (so the inclusion of occupational dummy variables) seems to be too restrictive. Angrist and Pischke (2009) define the direct inclusion of occupational dummy variables as "bad controls", because of their strong correlation with the education variable. They point out that we cannot treat the coefficients of educational variables as the returns to education because they include not only returns to schooling, but also possible selection bias (due to workers' self-selection into occupational categories). That is why, while estimating the returns to education it is better not to control for occupational dummies or for any other variables that are themselves caused by education. However, the purpose of the current study is to investigate not only the returns to education, but also the influence of education-

occupation mismatch on wages. That is why I propose a model that allows us to control for occupational categories in the wage equation.

I estimate the returns to education by modeling not only the wages but also the endogenous distribution of workers among occupational categories, and then I compare obtained results with those in the case of exogenous nature of these placements. I also take into account the endogenous nature of education for the wage equation. The current study estimates, in a reduced form, a joint model of educational choice, labor market participation, placement among occupational categories and wages. As we have seen above, the occupational type significantly influences the wages on the one hand. On the other hand, the occupational type is determined by education and other personal or household characteristics (observable or unobservable). The following model distinguishes each effect and analyzes other characteristics influencing the choice of occupational type and wages. This model provides the estimation of occupation-specific returns to schooling (so we could distinguish the returns to education-occupation match) and the estimation of the influence of education on the probability of being employed and on the probability of working in a particular occupational category. The model also allows us to control for not only the selection bias of being employed but also for the selection bias of being employed in a particular occupational category with correspondent requirements on productivity.

The model consists of four equations:

$$
\begin{cases}
(1) \quad D_{ed=j,i} = I(Educ_i = j, j = 1,2,3) \\
\qquad Educ_i = \begin{cases} 1, & if \quad E_i^* < 0 \\ 2, & if \ 0 \le E_i^* < \mu \\ 3, & if \ \mu \le E_i^* \end{cases}, \\
\qquad where \ E_i^* = X_i^{educ} * \gamma + \varepsilon_{1,i} \\
(2) \quad Y_{employed,i} = I(Y_i^* \ge 0), \\
\qquad where \ Y_i^* = \sum_{j=2}^{3} D_{ed=j,i} * \delta_{ed,j} + X_i^{empl} * \delta + \varepsilon_{2,i} \\
(3) \quad D_{occ=k,i} = I(O_i^{k*} > O_i^{l*}, l = 1,2,3, l \ne k), \\
\qquad where \ O_i^{k*} = \sum_{j=2}^{3} D_{ed=j,i} * \alpha_{ed,j}^{k} + X_i^{occup} * \alpha^k + u_{k,i}, \ k = 1,2,3 \\
(4) \quad W_i = \sum_{k=1}^{3} \sum_{j=2}^{3} (D_{ed=j,i} * D_{occ=k,i} * \beta_{educ,kj}) + \sum_{k=2}^{3} (D_{occ=k,i} \beta_{occ,k}) + X_{wage,i} \beta_{wage} + \varepsilon_{5,i}
\end{cases}
\qquad [3]
$$

Where (1) – educational choice equation, (2) – labor market participation, (3) – occupational choice, (4) – wage equation.

I assume a joint normal distribution for ε_{1i}, ε_{2i}, u_{1i}, u_{2i}, u_{3i}, ε_{5i}

$$
\begin{pmatrix} \varepsilon_1 \\ \varepsilon_2 \\ u_1 \\ u_2 \\ u_3 \\ \varepsilon_5 \end{pmatrix} = N \left\{ E_\varepsilon = \begin{pmatrix} 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \end{pmatrix}, \ \Sigma_\varepsilon = \begin{pmatrix} \sigma_{\varepsilon_1}^2 & \sigma_{\varepsilon_1\varepsilon_2} & \sigma_{\varepsilon_1 u_1} & \sigma_{\varepsilon_1 u_2} & \sigma_{\varepsilon_1 u_3} & \sigma_{\varepsilon_5\varepsilon_1} \\ \sigma_{\varepsilon_1\varepsilon_2} & \sigma_{\varepsilon_2}^2 & \sigma_{\varepsilon_2 u_1} & \sigma_{\varepsilon_2 u_2} & \sigma_{\varepsilon_2 u_3} & \sigma_{\varepsilon_5\varepsilon_2} \\ \sigma_{\varepsilon_1 u_1} & \sigma_{\varepsilon_2 u_1} & \sigma_{u_1}^2 & \sigma_{u_1 u_2} & \sigma_{u_1 u_3} & \sigma_{\varepsilon_5 u_1} \\ \sigma_{\varepsilon_1 u_2} & \sigma_{\varepsilon_2 u_2} & \sigma_{u_1 u_2} & \sigma_{u_2}^2 & \sigma_{u_2 u_3} & \sigma_{\varepsilon_5 u_2} \\ \sigma_{\varepsilon_1 u_3} & \sigma_{\varepsilon_2 u_3} & \sigma_{u_1 u_3} & \sigma_{u_2 u_3} & \sigma_{u_3}^2 & \sigma_{\varepsilon_5 u_3} \\ \sigma_{\varepsilon_5\varepsilon_1} & \sigma_{\varepsilon_5\varepsilon_2} & \sigma_{\varepsilon_5 u_1} & \sigma_{\varepsilon_5 u_2} & \sigma_{\varepsilon_5 u_3} & \sigma_{\varepsilon_5}^2 \end{pmatrix} \right\} \qquad [4]
$$

Covariates between stochastic terms reflect the unobserved characteristics of agent *i* that influence several depending variables at the same time: educational choice and wages, labor market participation and wages, occupational choices and wages, educational choice and labor market participation, labor market participation and occupational choices, as well as educational choice and occupational choices.

For normalization reasons it is assumed that: $\sigma^2_{\varepsilon_1}=1,\ \sigma^2_{\varepsilon_2}=1,\ \sigma^2_{u_1}=1,\ \sigma^2_{u_2}=1,\ \sigma^2_{u_3}=1$. Also for identification reasons I assume no correlation between stochastic components in the occupational choice equation ($\sigma_{u_1u_2}=0,\ \sigma_{u_1u_3}=0,\ \sigma_{u_2u_3}=0$). Therefore, stochastic terms in the model are jointly normally distributed with the following parameters:

$$\begin{pmatrix}\varepsilon_1\\ \varepsilon_2\\ u_1\\ u_2\\ u_3\\ \varepsilon_5\end{pmatrix} = N\left\{ E_\varepsilon = \begin{pmatrix}0\\0\\0\\0\\0\\0\end{pmatrix},\ \Sigma_\varepsilon = \begin{pmatrix} 1 & \sigma_{\varepsilon_1\varepsilon_2} & \sigma_{\varepsilon_1u_1} & \sigma_{\varepsilon_1u_2} & \sigma_{\varepsilon_1u_3} & \sigma_{\varepsilon_5\varepsilon_1}\\ \sigma_{\varepsilon_1\varepsilon_2} & 1 & \sigma_{\varepsilon_2u_1} & \sigma_{\varepsilon_2u_2} & \sigma_{\varepsilon_2u_3} & \sigma_{\varepsilon_5\varepsilon_2}\\ \sigma_{\varepsilon_1u_1} & \sigma_{\varepsilon_2u_1} & 1 & 0 & 0 & \sigma_{\varepsilon_5u_1}\\ \sigma_{\varepsilon_1u_2} & \sigma_{\varepsilon_2u_2} & 0 & 1 & 0 & \sigma_{\varepsilon_5u_2}\\ \sigma_{\varepsilon_1u_3} & \sigma_{\varepsilon_2u_3} & 0 & 0 & 1 & \sigma_{\varepsilon_5u_3}\\ \sigma_{\varepsilon_5\varepsilon_1} & \sigma_{\varepsilon_5\varepsilon_2} & \sigma_{\varepsilon_5u_1} & \sigma_{\varepsilon_5u_2} & \sigma_{\varepsilon_5u_3} & \sigma^2_{\varepsilon_5}\end{pmatrix}\right\} \qquad [5]$$

These are the equations of the system in more detail.

1) Educational choice is modeled as the choice among ordered educational levels (secondary or lower education, 1st level of tertiary education, 2nd level of tertiary education).

$$D_{ed=j,i} = I(Educ_i = j, j=1,2,3)$$

$$Educ_i = \begin{cases} 1, & if \quad E_i^* < 0 \\ 2, & if\ 0 \le E_i^* < \mu \\ 3, & if\ \mu \le E_i^* \end{cases}, \quad where\ E_i^* = X_i^{educ} * \gamma + \varepsilon_{1,i} \qquad [6]$$

where X_i^{educ} is the set of variables determining the educational choice of individuals.

I provide the results of estimation by both modeling the educational choice and by assuming its exogeneity.

The question of using instrumental variables for education while estimating the wage equations is already widely explored in the empirical literature [for a summary of studies and problems during estimations, see Card D. (1999)]. The most common variables used to instrument education are the following: features of the schooling system, family (childhood) background, and models using twins. The recent studies pointed out that the returns to education is not a single parameter across the population, but rather a random variable that may vary with other characteristics of individuals, such as race, family background, ability, school quality, etc. [Card and Krueger (1992), Altonji and Dunn (1996)].

From this standpoint of modeling endogenous educational choice, I propose two strategies in the choice of instrumental variables. Namely, as instruments I use the accessibility of tertiary education for population as the characteristic of the educational system, as well as the information about educational levels obtained by other household members. In the next section, I describe the choice of instrumental variables in more detail. I also include in the model the population heterogeneity in the returns to education and education-occupation match by observable characteristics (age and sex). I take into

account unobserved heterogeneity only through imposing the structure of stochastic terms of the model described above.

2) Selection: the binary choice model of being employed / unemployed is written as follows:

$$Y_{employed,i} = I(Y_i^* \geq 0), \ \ where\, Y_i^* = \sum_{j=2}^{3} D_{ed=j,i} * \delta_{ed,j} + X_i^{empl} * \delta + \varepsilon_{2,i} \qquad [7]$$

where $Y_i^* = w_i - w^{reserv}$, w_i is the wage which agent *i* could earn in the labor market and w^{reserv} is the reservation wage of agent *i*. Therefore, agent *i* accepts the work if and only if the wage which is proposed in the labor market is bigger than his reservation wage. w_i is determined by characteristics of agent *i* and labor market conditions, w^{reserv} is determined by the characteristics of the household of agent *i*. $D_{ed=j,i}$ is the set of variables related to the education of agent *i*, X^{empl}_i is the set of variable related to the characteristics of the labor market and the set of variables determining the reservation wage of agent *i*. ε_{2i} stands for unobserved characteristics of agent *i* that influence the probability of being employed. Here I follow a standard approach, proposed by Heckman (1979), to correct this kind of selection bias.

3) 1st Principal Equation and 2nd Selection Equation: the choice of occupational type within the job classification by skills level:

Agent *i* makes a choice between three occupational categories (according to required skills):

- *k=1*: for occupational types where the required educational level is secondary education;
- *k=2*: for occupational types where post-secondary professional education is required;
- *k=3*: for occupational types where higher professional education is required.

If we suppose that the goal of each individual is to get a job in which he will be most productive (so with the highest level of salary) we could write the model of choice of occupational types in the following way (taking a similar approach to that of Lee (1983) and Dolton et al. (1989)):

$$D_{occ=k,i} = I(O_i^{k*} > O_i^{l*}, l = 1,2,3, l \neq k), \ where\, O_i^{k*} = \sum_{j=2}^{3} D_{ed=j,i} * \alpha_{ed,j}^{k} + X_i^{occup} * \alpha^k + u_{k,i}, \ k = 1,2,3 \qquad [8]$$

X^{occup}_i is the set of variables influencing the occupational choices, u_{ki} stands for unobserved characteristics of agent *i* that influence the probability of being employed in a particular occupational category. The normalization was made relative to the 1st occupational category: $\varepsilon_{3,i} = u_{2,i} - u_{1,i}$, $\varepsilon_{4,i} = u_{3,i} - u_{1,i}$.

Therefore, I estimate the following covariance matrix for stochastic elements:

$$\begin{pmatrix} \varepsilon_1 \\ \varepsilon_2 \\ \varepsilon_3 \\ \varepsilon_4 \\ \varepsilon_5 \end{pmatrix} = N\left\{ E_\varepsilon = \begin{pmatrix} 0 \\ 0 \\ 0 \\ 0 \\ 0 \end{pmatrix}, \ \Sigma_\varepsilon = \begin{pmatrix} 1 & \sigma_{\varepsilon_1\varepsilon_2} & \sigma_{\varepsilon_3\varepsilon_1} & \sigma_{\varepsilon_4\varepsilon_1} & \sigma_{\varepsilon_5\varepsilon_1} \\ \sigma_{\varepsilon_2\varepsilon_1} & 1 & \sigma_{\varepsilon_3\varepsilon_2} & \sigma_{\varepsilon_4\varepsilon_2} & \sigma_{\varepsilon_5\varepsilon_2} \\ \sigma_{\varepsilon_3\varepsilon_1} & \sigma_{\varepsilon_3\varepsilon_2} & 2 & 1 & \sigma_{\varepsilon_5\varepsilon_3} \\ \sigma_{\varepsilon_4\varepsilon_1} & \sigma_{\varepsilon_4\varepsilon_2} & 1 & 2 & \sigma_{\varepsilon_5\varepsilon_4} \\ \sigma_{\varepsilon_5\varepsilon_1} & \sigma_{\varepsilon_5\varepsilon_2} & \sigma_{\varepsilon_5\varepsilon_3} & \sigma_{\varepsilon_5\varepsilon_4} & \sigma^2_{\varepsilon_5} \end{pmatrix} \right\} \qquad [9]$$

4) Principal Equation 2: the wage equation.

$$W_i = \sum_{k=1}^{3}\sum_{j=2}^{3}(D_{ed=j,i} * D_{occ=k,i} * \beta_{educ,kj}) + \sum_{k=2}^{3}(D_{occ=k,i}\beta_{occ,k}) + X_{wage,i}\beta_{wage} + \varepsilon_{5,i} \qquad [10]$$

Where $D_{ed=j,i}$ is the set of variables related to the education of agent *i*, $D_{occ=j,i}$ is the set of variables related to the occupation of agent *i*, $X_{wage,i}$ is the set of variables characterizing the work of agent *i,* and other characteristics influencing the individual wage. ε_{5i} stands for unobserved characteristics of agent *i* that influence his wage. In estimating the model, I take into account the heterogeneity of the returns to schooling within population, but I analyze only observed heterogeneity following from sex and age groups. Thus, I divide our sample into four groups: male, female, 24-35 and 36-55 year-olds; and I suppose the homogeneity within these groups. The separation by age groups is also motivated by the possible difference in the returns to education obtained by those educated in the Soviet period and during the transition period. I include in the forth equation all possible combinations of dummy variables indicating educational level, occupational category, sex and age group. Thereby, I receive the saturated equation of wage.

The following set of parameters of the model: $\gamma, \delta_{ed,j}, \delta, \alpha^k_{ed,j}, \alpha^k, \beta_{educ,kj}, \beta_{occ,k}, \beta_{wage}$, $\sigma_{\varepsilon_2\varepsilon_1}, \sigma_{\varepsilon_3\varepsilon_1}, \sigma_{\varepsilon_4\varepsilon_1}, \sigma_{\varepsilon_5\varepsilon_1}, \sigma_{\varepsilon_3\varepsilon_2}, \sigma_{\varepsilon_4\varepsilon_2}, \sigma_{\varepsilon_5\varepsilon_2}, \sigma_{\varepsilon_5\varepsilon_3}, \sigma_{\varepsilon_5\varepsilon_4}, \sigma^2_{\varepsilon_5}$ is estimated by the Simulated Full-Information Maximum Likelihood method. I use the GHK (Geweke-Hajivassiliou-Keane) smooth recursive simulator to approximate the joint distributions of higher than two orders [Hajivassiliou (1990), Geweke (1991), Keane (1994)].

6. Data Description

6.1 Database

I use the data from the Russian Longitudinal Monitoring Survey (RLMS). It is a series of nationally representative surveys designed to monitor the effects of Russian reforms on the health and economic welfare of households and individuals in the Russian Federation [a description of RLMS data & statistical approach can be found in Swafford M. et al. (1999)]. This base offers several important advantages for our analysis in comparison to other statistical sources available in Russia. The most important is that it includes two surveys: household data and individual data. By combining these surveys, I have an opportunity to generate a full set of data determining individual and household characteristics.[17] I use the data for 2005 that includes 4837 observations of people 24-55 years old (2652 female and 2185 male). I chose the sub-population of the age 24-55 for the analysis as it is the principal working age in the Russian labor market.

6.2 Variables

Dependent variables. Employment Status: I consider the person to be employed if he claims to be employed, either by an employer or by himself. Occupational Status: I consider the occupational status also according to the personal statement during the interview. Occupation Status is set to 1 if an individual works within occupational types where a secondary education is the required level according to the job classification. Occupation Status is set to 2 if an individual works in an occupational type where post-secondary professional education is required. And, finally, the Occupation Status is set to 3 if an individual works within occupational types where higher education is required according to the job classification. The values of this variable correspond to the structure of occupations used previously in this study. Wage: I use the logarithm of the wage earned during the previous month to the period of

[17] The program code, which combines two datasets and extracts all intra-family connections (parentage, sibling connections and others), and thereby provides the characteristics of other household members (which I use extensively in the current study), could be available from the author upon a request.

the interview on the primary job declared, including actual cash, payments via products from employer, and the accrued but not paid part of the salary.

Explanatory variables. The list of explanatory variables for each equation is presented in the table 8.1. The summary of statistical characteristics for dependent variable and explanatory variables is presented in Table 8.2.

6.3 Identification. Exclusion Variables

The model identification does not rely only on the functional assumptions imposed on the residual distribution, which I described above, but also relies on exclusion restrictions. Below I list the exclusion variables for each equation in the model.

1) Educational Choice. As I have already mentioned, there are many studies using different instruments for educational choices. In each particular case, an author is limited by an available dataset and particular mechanism of educational choices that exists in an analyzed country. As Angrist and Pischke (2009) pointed out, good instruments come from institutional knowledge and one's ideas about the processes determining the variable of interest. A good example of such an approach is the work of Angrist and Krueger (1991), where they exploit the variation induced by compulsory schooling laws.

In the current study, I make use of the institutional structure of the Russian educational system. More precisely, I create my instruments based on the characteristics of the educational system in the Russian Federation in the period correspondent to the year when an analyzed person turns eighteen. I analyze the cohorts born between 1955-1981. These individuals were making their educational decisions at age 17-18, thus, between 1973-1999. As I have already underlined, during the Soviet period and first years of transition (which includes the period 1973-1999) the government financed tertiary education in full. Nevertheless, the number of available places in universities, colleges and vocational education institutions was limited. Potential students obtained their admission on a competitive basis. Thus, if we imagine the distribution of abilities of a cohort of secondary school graduates, we could assume that only the individuals in a top part of this distribution (so with higher abilities versus other individuals in a correspondent cohort) would be admitted to tertiary education (1^{st} and 2^{nd} level of tertiary education). Therefore, we can find out two exogenous sources of variation in one's probability to be admitted to the tertiary education institutions. The first source is the number of places available for admission (which were regulated and determined by the government and institutions). The second source is the size of a correspondent cohort. If in a particular year more people graduated from secondary school (because of an increase in birth rates 17 years ago), lower ability pupils would have had significantly fewer chances to obtain admission than if they were born during a recession in birth rates. In other words, during the periods that correspond to the recession in birth rates the average abilities of admitted students into tertiary education was lower than in the years that correspond to the increase in birth rates. The admission probabilities depend on the ratio of available places in the tertiary education system to the cohort size. Undoubtedly, I have to assume here that the increase in fertility does not result in a disproportionate increase in a number of children with particular level of abilities (higher or lower ability children).

Individuals make schooling choices after secondary school graduation at age 17-18 based on their skill endowment, individual preferences and potential returns to education.[18] I use the ratio of students

[18] Pupils graduated from secondary school at 16-17 years old. We could not ignore that some of them were not going directly to tertiary education (because of a failure during admission exams, military services attendance for the male population or due to other reasons) and attended tertiary education later. However, I do believe in the consistency of such an approach to the instrumental modeling of educational choices, mainly because it still allows us to

in the whole population for 1st and 2nd tertiary educational levels and graduation rates in 1st and 2nd tertiary educational levels in the period correspondent to the year when an analyzed person turns eighteen. These variables characterize the accessibility of the post-secondary education for the people in a particular cohort as well as the probability that they would obtain a degree.

I also include in some specifications other instruments – variables describing the educational level of other household members in the educational choice equation. The only available information is about people living in the same household, and there is no information on parents' education unless the person still lives with his parents (which could provide another selection bias). Therefore, I use the indicators for maximal levels of education obtained by other members. These indicators positively correlate with individual educational levels and it seems that they do not directly influence individual wages.

I provide four estimation results: without the equation of educational choice; with the first set of instrumental variables (characteristics of the educational system); with the second set of instrumental variables (education of other family members); and with both sets of instrumental variables.

2) Labor Market Participation. First, in the equation of labor market participation I include the regional characteristics of labor market: regional unemployment rates (by 39 regions). Second, I include some characteristics of a household. This comprises the presence of children under 3 years old, from 4 to 7 years old and from 8 to 18 years old separately for men and women; number of members in the household; household activities (land use, stock farming, living conditions, renting); and household revenues (revenues of other household members by person, revenues from home production and revenues from other household activities).

3) Occupational Choice. First, in the equation of occupational choice I include the characteristics of occupations of other household members, more precisely, the maximal occupational category, in which other members of the household work. By these variables, I attempt to capture the effect of the social network during job searches and promotions within a job. These variables may also reflect the "homogeneity" of families, in other words the fact that people tend to find their partners in universities or at work (so tend to have partners with similar educational or/and occupational characteristics). Unfortunately, our dataset does not allow us to determine the pure effect of social networks on job opportunities, but the obtained results are interesting and also provide evidence of possible influence of other family members' occupations on one's occupational choice. Second, I include the individual's health characteristics (presence of chronic diseases, smoking and alcohol consumption) as well as lifestyle characteristics (frequency of sport activities and physical trainings). The last variables significantly influence the occupational choice, but not the final wage.

4) Wage Equation.

Additionally to standard variables describing the education, experience and tenure, I add in the wage equation the following job characteristics: the number of hours worked, presence and number of subordinates, ownership status of enterprise (state, foreign private capital, Russian private capital, individual entrepreneurships), job consideration as dangerous, and seventeen types of industries.

capture the variance of abilities. Firstly, taking into account that I have institutional data not on a yearly basis, but on a 3-5 years basis, and this data structure allows for a larger period for each individual to make an education decision. Secondly, the factors resulting in the delay of one's tertiary education attendance (especially the failure during admission exams) could also reflect the place of such an individual in a population's distribution of abilities, and thus our instruments could partially capture these factors.

7. Results of Estimation

This section is organized in the following way. First, I present the results of the standard Mincer's wage equation estimation with the control for selection bias under the assumption of exogenous distribution of workers among occupational categories. Second, I present the results of the estimation of the returns to education and of the returns to education-occupation match controlling for endogenous choice of education and occupation.

7.1. Wage equation estimation under assumption of exogenous distribution among occupational categories

Table 10 lists the coefficients estimated for the returns to education when controlling for selection bias [following Heckman (1976, 1979)]. I estimate three specification forms: i) standard selection model without dummy variables for occupational types; ii) selection model with dummy variables for occupational types; iii) selection model with dummy variables for occupational types under the assumption of different returns to education within different occupational categories (to capture the returns to undereducation, required level of education and overeducation). Control variables, which were used for estimation, are presented in table 8.1.

The coefficients related to the returns to higher education (2nd level of tertiary education) are positive and significant in all three specifications. Coefficients related to the returns to secondary and post-secondary professional education (1st level of tertiary education) are positive but not significant for all analyzed sub-groups of the population. The returns to tertiary education are higher for the female population than for the male population.

When the dummy variables for occupational types were added (2nd specification), the returns to tertiary education became lower (compared to the 1st specification). Accordingly, we see that the wages are dependent on the educational types and on the occupational types. This estimation corresponds to previous research for the Russian Federation and I list it only as a reference for the following comparison with more detailed estimations.

Under the assumption that the returns to education are not the same within different occupational types (3rd specification) but with exogenous placement of workers among the occupations and with the control for selection bias of being employed, I obtain the following results. We see that the returns to education are different within different occupational categories and, moreover, the dummy variables for occupational categories are insignificant; hence, the occupational categories provide no difference in wages but education provides the difference in wages within each occupational category. Thus, the estimation of the standard Mincer's equation with dummy variables for occupation provides us with a rough estimation that does not show the nature of the returns to education on the analyzed emerging market.

As discussed above, the distribution among occupational types depends on the education but is not strictly determined by it. Therefore, this specification is not perfectly appropriate for the Russian labor market analysis. Now we turn to the problem of the endogenous structure of the distribution among occupations. Below I present the result of the joint reduced form model estimation, controlling for the endogeneity of educational choice.

7.2. Wage equation estimation under the assumption of the endogenous distribution among occupational categories. (Different returns to education within different occupational categories & endogenous nature of distribution among occupational categories. Control for endogenous nature of educational levels obtained).

I use four specifications in this estimation according to the model described above. The first specification (first column accordingly) is the reduced-form joint model of labor market participation, occupational choice and wages. In this specification, educational variables are assumed to be exogenous for the wage equation. In the second, third and fourth specifications I take into account the endogeneity of educational variables. As discussed above, three specifications are used for modeling educational choice: with educational system characteristics as instrumental variables, with other family members' educational characteristics as instrumental variables, and with both of them (the second, third and fourth specifications correspondingly). Complete results of the estimations are presented in Table 11. Table 12 lists the estimation of coefficients obtained for the returns to education in four estimated specifications with endogenous occupational choice.

Firstly, I discuss the difference in results using different instruments for education in our estimations, and then I move to the detailed analysis of the results.

The results show the higher estimations of the rate of returns to education in the specifications with instrumental variables for education. Previous studies [see Card (1999) for more details], that used instrumental variables for the estimation of the returns to education, also showed higher rates of return using IV method versus OLS. What I would like to underline here is that the use of educational system accessibility characteristics as an instrument gives us significantly higher estimation results of the returns to education versus other specifications. The cause of this may rely on the fact that the increasing accessibility of tertiary education attracts more people to obtain a higher educational level and most likely affects the decisions of those who would otherwise have relatively low levels of education. The rates of return to education estimated by IV could be expected to be higher than OLS estimations if the marginal rates of returns to education are negatively correlated with the level of schooling across the population [Card (1999)]. In other words, this negative correlation means that if the returns to tertiary education for those people who have low chances to enter the educational system are higher than the returns to education for those who have higher opportunities to get tertiary education (higher abilities levels). Thus, using this instrument we capture the local average treatment effect, which corresponds to the middle-ability population.

In spite of these differences in the results obtained by using different specifications for the education equation, the main conclusions about returns to education within different occupational categories and about the influence of education-occupation match on wages stay the same for all these specifications. Below I describe the main findings.

As can be seen from the presented results, the returns to education are different among occupational groups, or, in other words, the returns to occupations are not the same for all individuals and for all educational groups (as it is supposed during the standard Mincer's wage equation estimation). In several specifications (first and second ones) I obtain a significant coefficient for the 2nd occupational type, but it is always insignificant for the 3rd occupational type. Therefore, only the fact of working in the 3rd occupational type does not increase the wage.

The results suggest higher rates of return to higher education (2nd level of tertiary education) for women than for men and the higher rates of return to post-secondary professional education (1st level

of tertiary education) for men. The returns to tertiary education are higher for younger workers (23-35 years old) within first and second occupational types than within the third occupational group, and is higher for older workers (36-55 years old) within the third occupational type than within the first or second ones.

Within first and second occupational types (the lowest and the middle in the analyzed hierarchy), the returns to tertiary education are higher for 24-35-year-old workers, than for older ones. Returns to higher education are higher for women, and returns to post-secondary professional education are higher for men. The younger male workers without tertiary education earn more than older ones and female workers. Thus, according to the fourth specification the returns to the first level of tertiary education for the male population are about 16% for younger workers and 18% for older workers. Returns to higher education is about 23% for 23-35 year-old-male workers, 73% for 23-35-year-old female workers, and 44% for 36-55-year-old female workers.

Within the third occupational type the younger workers without tertiary education earn significantly higher wages than the older ones (+79% for female and +116% for male workers). The results also show that for the younger population the third occupational type provides additional payment even if they do not have a required level of education for this level of work. On the other hand, the returns to tertiary education for younger workers are lower in the third occupational type. The post-secondary professional education increases wages only for the 36-55-year-old female population by 39%. The returns to tertiary education for younger female workers are 21% (lower than in other occupational types); for older female workers it is 129% (significantly higher than in lower occupational types).

Taking into account the different levels of returns to education by occupational groups, I obtain higher rates for returns in higher occupational levels and lower returns within the first occupational level (where only secondary education is required). If I take into account the endogenous nature of the occupational choice process, I obtain even higher estimations of the returns to tertiary education and especially of the returns to higher education within higher occupational types. As soon as I relaxed the hypothesis about the independence of two equations for occupational choice and wages, thus, controlling for self-selection into occupational categories, I get a larger gap in salaries between individuals with different education within each occupational group, but I find no returns to occupational categories.

Below in Table 13 I present the estimated covariance matrix for random components for four specifications of our joint reduced-form model.

For all specifications, we can reject the hypothesis of zero correlation between all random components in the model. We see that the random components in occupational choice equations are negatively correlated with the random component in the wage equation. The unobserved characteristics (random components) that influence the wage positively influence the probability of working in the second and third occupational levels rather than working in the first one and vice versa. The random component in a labor market participation equation is also negatively correlated with the random component in the wage equation (this result corresponds to those from the standard selection model). The random component in the educational choice equation is correlated negatively with the random component in the wage equation, as well as with the random component in the labor market participation equation, and is correlated positively with random terms in the occupational choice equations (for the second and the third occupational type choices versus the first one). In the next sub-section we will see in more detail our results obtained on the random components of the model.

7.3. Model Fit

I briefly present a fit analysis of the estimated model in this section. I use the fourth specification of the model as illustration. Table 14 presents predicted probabilities of educational choices, employment and employment in particular occupational sectors as well as these probabilities observed in data. We can see that these probabilities are quite well replicated.

Figure 11 presents the observed distribution of wages as well as distribution of wages predicted by the current model (prediction by wage equation and prediction with taking into account labor market and occupational categories selection). I list 4 graphics: for the entire population and by educational categories. We find a satisfactory fit for all of them.

7.4. Simulations

I present in this section some simulations that allow us to analyze predictions obtained by the current model. In the analyzed model, the random term in each equation is distributed conditionally on those in other equations. Thus, unobservables in the labor market participation equation are distributed conditionally on those in the educational choice equation; unobservables in the occupational choice equation conditionally on those in the educational choice and labor market participation equations; and the random term in the wage equation is distributed conditionally on error terms in the educational choice, labor markets participation and occupational choice equations. I use the fourth specification of the model for this analysis.

First, I simulate the predicted probabilities of employment conditionally on education obtained for the entire population and separately for male and female populations (Figure 12). Figure 12 suggests that education significantly determines the probability of being employed, especially for women.

The fact of living in a household increases the probability of working for both men and women. Individuals who live with household members who have higher income levels (total income of other members divided by the number of persons living in a household) have lower probabilities of working compared to persons living with household members with lower income. Figure 13 presents the probabilities of being employed for single men and women, for persons with high levels of other members' income (higher 25% of distribution) and for persons with low levels of other members' income (low 25% of distribution). The fact of having other members with relatively high levels of income or being single significantly decreases the probability of being employed for both men and women but much more significantly for men than for women. Inversely, the fact of living in a household with relatively low income of other members (divided by the number of persons in a household) stimulates significantly more men to work than women.

Second, I simulate the predicted probabilities of employment in particular occupational categories conditionally on education obtained for the entire population and separately for male and female populations (Figure 14). Figure 14 shows that education is one of the determining factors for the distribution among occupational categories. The presence of tertiary education is a more crucial factor for the male population to get a job in a higher occupational category. Nevertheless, the presence of higher education increases a probability to work in the 3rd occupational category significantly more for the female population than for the male population.

Figures 15 and 16 depict some interesting results regarding the influence of other family members on occupational choice. The presence of other family members working in the 3rd occupational

category significantly increases the probability of working in the 3rd occupational category for women without higher education, so above their qualifications (Figure 15), and does not significantly influence the employment for the male population. The absence of other members working in the 2nd or the 3rd occupational categories significantly decreases the probability of working in the 2nd and the 3rd occupational types even for individuals with correspondent educational levels (Figure 16). These facts could be evidence of the importance of family networks during the job search.

One of the factors that could play a significant role in education-occupation mismatch for workers is tenure (experience of work at a current working place). In order to understand to what extent tenure increases the probability of working within occupations above the worker's educational level and whether the beginners at the company accept to work at lower occupational levels, I simulate the probability of being employed in higher and lower occupational categories, relative to educational levels obtained, conditional on tenure. I divided all workers into three groups: with tenure less than 5 years, with tenure between 5 and 10 years, with tenure higher than 10 years.

Figure 17 presents simulated probabilities of working in a higher occupational category for workers with first and second educational levels. We can see that tenure significantly increases the probability of working at higher occupational levels for women; nevertheless, the influence of tenure on this probability is much less for the male population.

Figure 18 shows simulated probabilities of working in lower occupational categories for workers with second and third educational levels. Tenure significantly decreases this probability for women; at the same time, the influence of tenure on this probability is much less for the male population. Consequently, female beginners in Russian companies more frequently accept working in lower occupational types than male beginners.

Finally, I simulate the predicted wages for workers by educational levels, sex and age in all occupational categories. Results are presented in Figure 19.

The graph 19 illustrates the distribution of predicted values of wages for different occupational categories for individuals grouped by educational levels, sex and age. We can see that expected wages in the 2nd or the 3rd occupational types for people without required levels of education do not significantly exceed the expected wages in occupational categories that correspond to their educational levels. At the same time, the expected wages in occupational categories correspondent to the obtained educational level are higher than expected wages in lower occupational categories. These are results for the entire population; nevertheless, we could remark some differences in expected wage distribution for the male and female populations as well as for different age groups.

For younger workers (24-35 years old) without tertiary education the expected returns to the highest occupational categories are significantly higher than for older workers (36-55 years old). On the other hand, for older workers with higher education the loss in wages in case of working at the lower occupational levels is much higher than for younger workers with higher education. For the female population with higher education the expected loss in revenues in case of working at the lower occupational levels is significantly higher than for the male population, and we have the inverse situation for the male and the female population with the 1st level of tertiary education.

Finally, we can clearly see that the expected revenues are not necessary higher in higher occupational levels for all population groups. The returns to occupational categories depend on other characteristics, such as education, sex and age.

The obtained results totally correspond to our findings on the comparison of the Russian labor market with the French labor market. They show that even if we obtain relatively high levels of the rate of return to tertiary education in Russia, this does not mean that the Russian labor market has become close to the labor market of a developed country. The previous Soviet Planning System continues influence wage formation. More exactly, there is no market pay for higher levels of occupation on the market. Nevertheless, the higher productivity of workers within each occupational type is rewarded even with the significant education-occupation mismatch existing on the Russian market. Tertiary education increases this productivity within all occupational types and the returns to tertiary education are higher within higher levels of occupation. More exactly, we see the returns to higher education in all occupational types and they are growing with higher levels of occupation. There is a return to post-secondary professional education only within the two first occupational groups (where there is no requirement for higher education) and there is no return to it within the third occupational group, where higher education is required. Thus, the Russian labor market is moving toward labor markets in developed countries but still requires significant changes in terms of correcting education-occupation match and payment for occupations.

Before moving to our conclusion, I present in the following subsection other interesting results that I have obtained during the model estimation.

7.5. Other Results from Estimation

Some of the results listed below are consistent with findings of previous research for the Russian labor market. At the same time, the current study is the first to report the influence of income of other household members, household activities and regional unemployment rates on employability, influence of family members' occupations and individual tenure on distribution among occupational categories as well as the influence of individual characteristics related to health and sport activities on occupational choice and wages. The complete results of estimations are presented in Table 11.

Labor market Characteristics. The regional unemployment rate, as it was expected, negatively influences the probability of being employed.

Occupational Levels of other household members. The fact that the other members work only within the 1st (lowest) occupational type significantly decreases the probability of being employed in the 2nd or 3rd occupational types. On the other hand, the presence of other people employed in the 3rd occupational type in a household significantly increases the probability of being employed in the 3rd occupational type, especially for the female population. This could be evidence for the influence of network relationships on employment and occupational choice.

Individual Tenure. I tested the influence of tenure (experience at a current working place) on the distribution among occupational categories. More precisely, I tested whether individuals are promoted to the higher occupational types due to their level of experience at a current working place. I found that tenure has a significant positive influence on the probability of working in the 2nd and 3rd occupational categories but only for the female population. I have found no significant effects for the male population. At the same time, I found a positive influence of tenure on male wages and an insignificant influence on wages for the female population. This provides evidence that the move from lower occupational categories to the higher ones (whatever the level of education is) could be explained by tenure, but only for the female population. At the same time for the male population, in contrast to the female population, tenure increases wages significantly.

Individual Experience. To estimate the influence of experience on wages and occupational choice the variable of the potential experience has been constructed as difference between age (minus 18 years) and years spent on education after 18. I found no significant influence of individual experience on wages. Nevertheless, experience has a negative effect on the probability of being employed (for both male and female populations), a negative effect on the probability of working in the 2nd occupational group versus the first one and a positive effect on the probability of working in the 3rd occupational group.

Home Production of Household. The home production of livestock as well as production of any agricultural products with selling purposes decreases the probability of being employed.

Income of Other Members of Household. The higher the income of other members in a household (by number of persons in household), the lower the probability of being employed for the male and female populations, and this influence is higher for the female population. This confirms the theoretical results that the income of other members is regarded as non-labor income and therefore increases the reservation wage.

Sex. I did not find a significant influence of sex on the probability of being employed or on the probability of being employed in particular occupational categories. I also noticed that the wages are higher for the male population than for the female by 51%.

Family & Children. The presence of family increases the probability of being employed for the population. The presence of 8-18-year-old children increases the probability of being employed for the male population. The presence of children less than 8 years old significantly decreases the probability of being employed for the female population.

Characteristics of Health & Sport Activities. The fact that a person smokes and consumes a large quantity of alcohol decreases the probability of getting a higher occupational type. Sport activities significantly influence the occupational level. Regular sport activities increase the probability of being employed in a higher occupational level. The absence of sport activities decreases this probability for the entire population. Sport activities and health characteristics do not significantly influence wages.

Regional Characteristics. Wages are different within regions. In cities and towns, both the probability of being employed and wages are higher than in villages. Wages are higher in Moscow and Saint Petersburg and their regions.

Enterprise Types & Industries. I confirm the fact that the state enterprises pay lower wages than the firms of the private sector with foreign capital or Russian capital. Among industries, the following ones pay higher wages on the market: natural resources industries (the oil and gas industry and energy industry) and commercial service industries (construction, transport, communication, finance, trade and consumer services). Public services (military-industrial complex, agriculture, machinery of government, education, science and culture, public health service, army, defence and security services) are characterized by lower wages on the market. Dangerous work conditions are also compensated by wages.

8. Conclusion

This paper made a thorough analysis of the returns to the tertiary education and education-occupation match within the transition economies compared to developed economies. I have shown through the example of the Russian Federation that the increase in the returns to education which happened in previous years does not indicate that the labor market is becoming closer to that of developed countries.

I have deconstructed the standard estimation of the returns to education in three parts characterizing the labor market: education-occupation match, payment for occupations and payment for productivity within occupations. First, I have found that there is a significant education-occupation mismatch in the Russian labor market and that the occupational placement does not strictly depend on the productivity, the family networks and revenue influence significantly the choice of higher occupational levels. Second, I have shown that there is no significant payment for occupation in the Russian Federation. From this finding, the current situation on the market is closer to the previous Soviet economy than to developed economies (for example, the French labor market). Thirdly, I have shown that there is a significant payment for productivity and thus education within each occupational type. Further, the higher the level of occupation is, the higher the gap is in wages between workers with secondary and post-secondary education. I have made a special focus on the distribution of the labor force by occupational type. In previous studies, it has been shown that the occupational type influences significantly the wage on the Russian labor market, but this variable was never treated as endogenous. Taking into account the endogeneity of occupational choice, I have found that the occupational type does not influence the wage but the returns to education are different within different occupational types.

I have focused also on the estimation of the returns to education among male and female populations separately and by age groups. In the specifications of standard Mincer's equation for wage and with control for selection bias, I found results in line with previous research for the Russian Federation. I also prove, as previous research did, that the returns to education are different for men and women (for the female population, the returns to tertiary education are higher). Furthermore, this difference becomes much more significant when I take into account the endogenous occupational choice; indeed, the wage formation is different between male and female populations. The tertiary education is a more crucial factor for the male population to get job in a higher occupational category; nevertheless, the presence of higher education increases the probability to work in the highest occupational category significantly more for women than for men. The distribution of the female population among occupational categories is more influenced by the occupational status of other household members. For women this could result in work in higher or lower occupational categories depending on the presence of other household members working there. For men the absence of other household members in higher occupational categories could lead to the fact of working in lower occupational categories. I also showed that the tenure increases significantly the probability of working in higher occupational categories for women, and tenure does not influence significantly the male occupational positions, but increases their wages (in contrast to the female population). I showed that the expected revenues are not necessary higher in higher occupational levels for the entire population groups. The returns to occupational categories depend on other characteristics, such as education, sex and age. Finally, there is a positive return to tertiary education within each occupational type. From the result of estimation by age group, I could conclude that the returns to education and the returns to occupational types are higher for younger workers than for older workers. This demonstrates clearly the changes in the mechanism of wages formation happening now in the labor market.

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Official site of RLMS www.cpc.unc.edu/projects/rlms/rlms_home

APPENDIX II. The Russian Federation versus France: Occupational Placement and Wages Distribution.

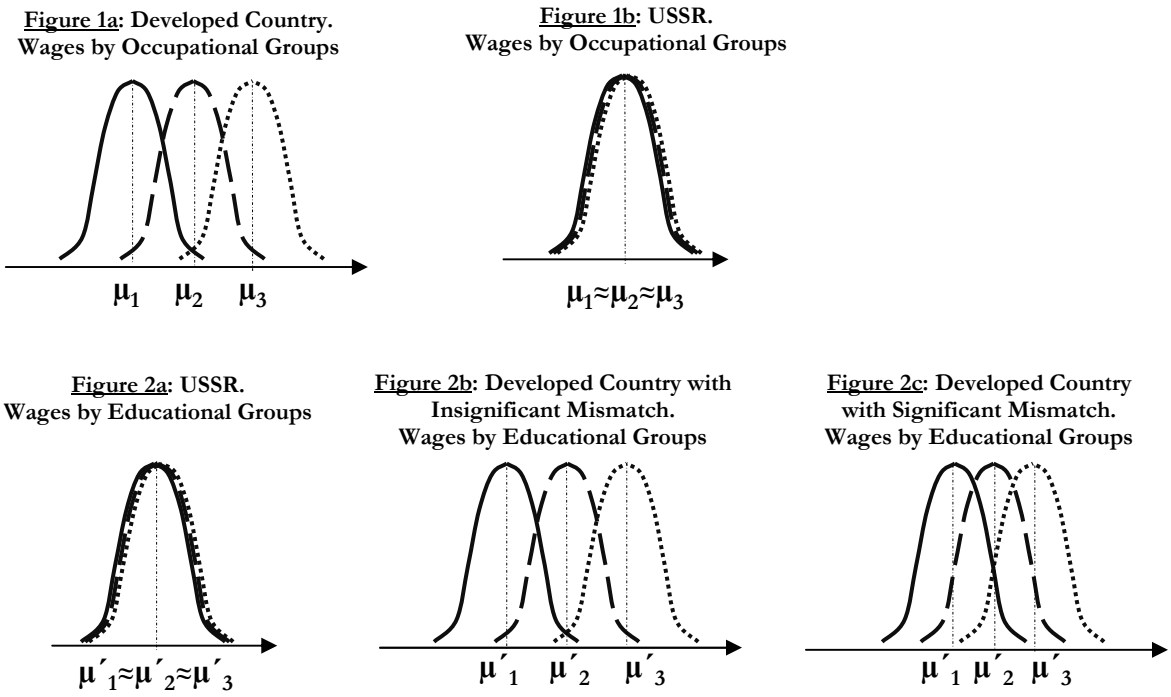
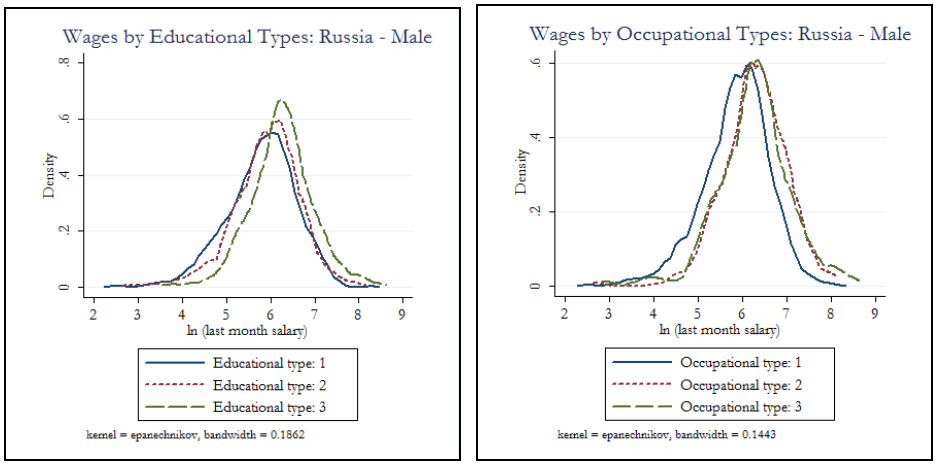


Figure 4: The Russian Federation. Kernel density estimates of the logarithm of wages for female &male populations, age 24-55, 2005 year.



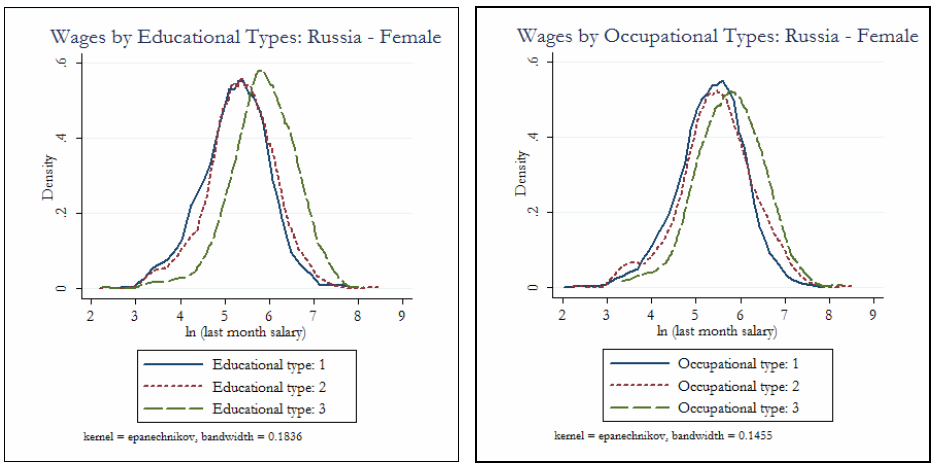


Figure 5: The Russian Federation. Kernel density estimates of the logarithm of wages within Occupational Categories for female &male populations, age 24-55, 2005 year.

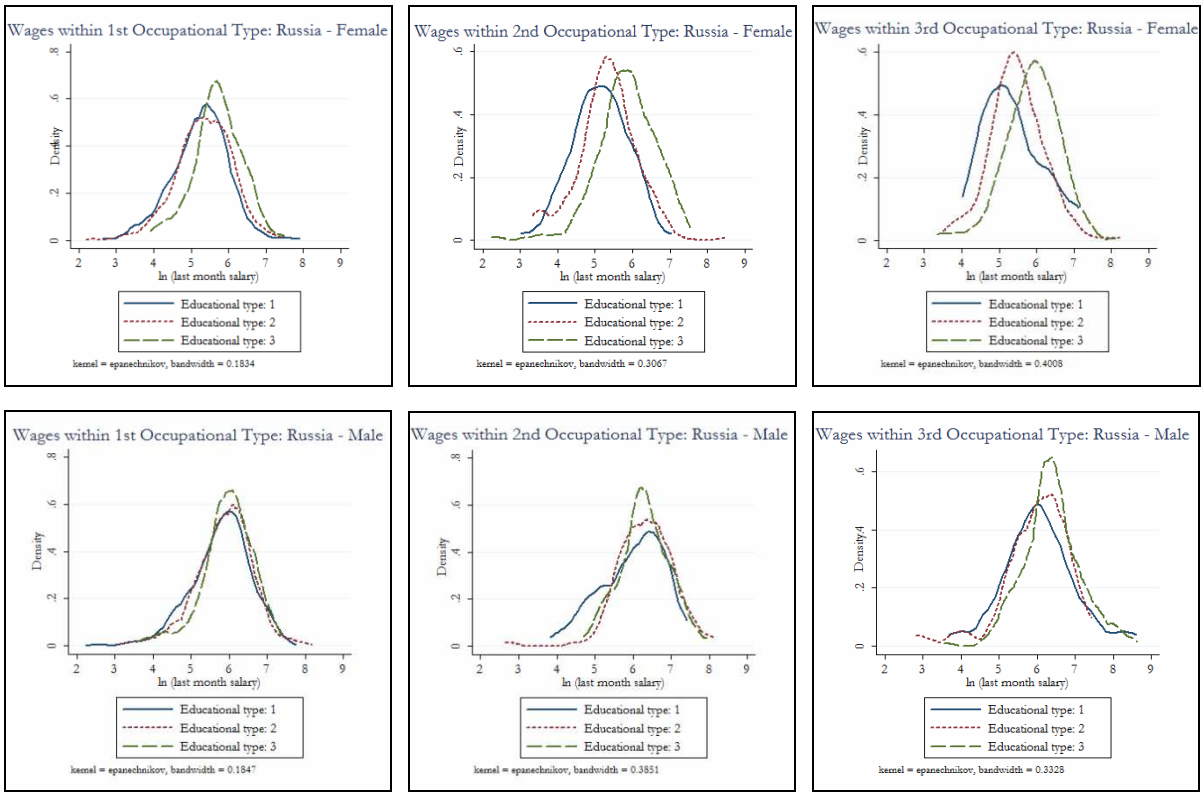


Figure 6: The Russian Federation. Kernel density estimates of the logarithm of wages within Educational Groups for female &male populations, age 24-55, 2005 year.

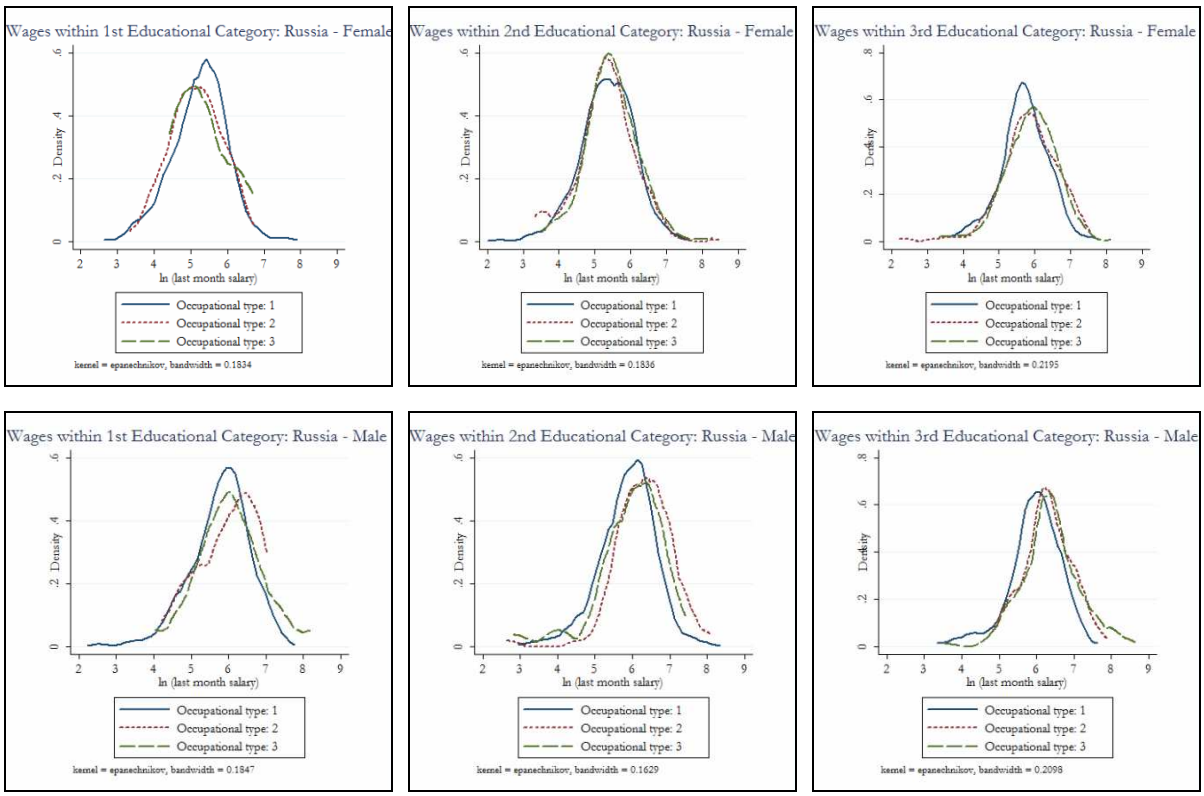


Figure 7:
France. Kernel density estimates of the logarithm of wages among Educational Groups for female &male populations, age 24-55, 2002 year.

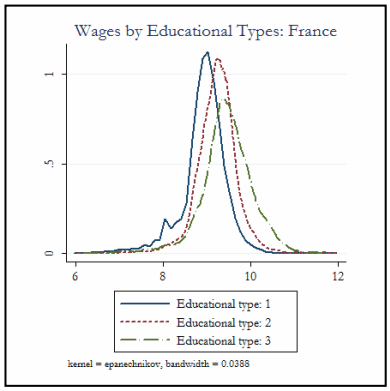


Figure 8:
France. Kernel density estimates of the logarithm of wages among Occupational Groups for female &male populations, age 24-55, 2002 year.

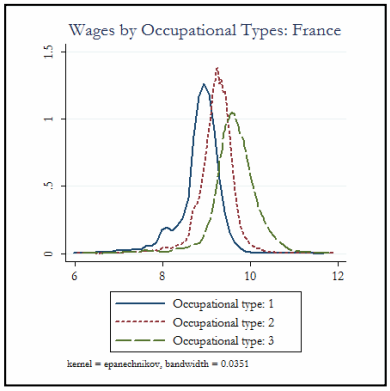


Figure 9: France. Kernel density estimates of the logarithm of wages within Occupational Groups for female &male populations, age 24-55, 2002 year.

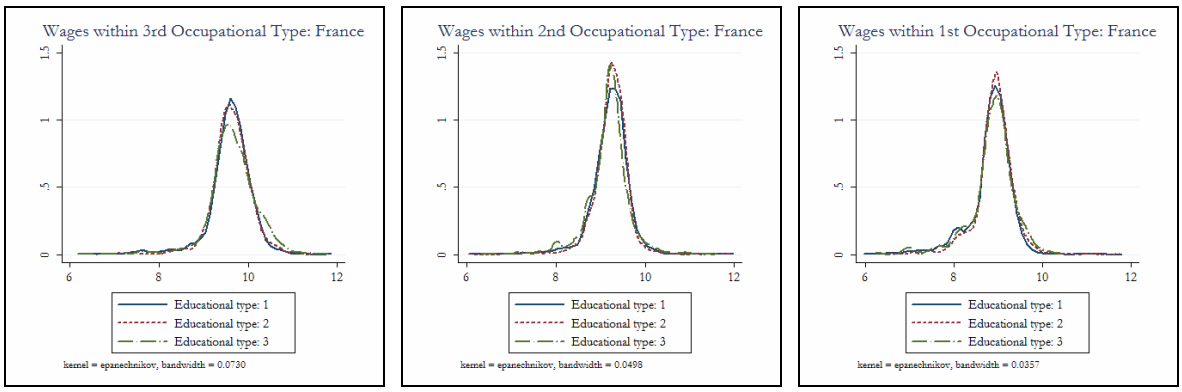
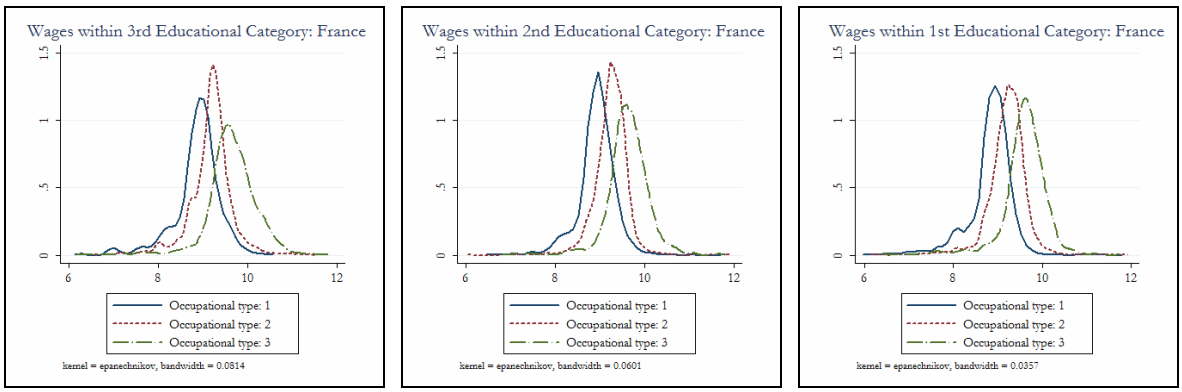


Figure 10: France. Kernel density estimates of the logarithm of wages within Educational Groups for female &male populations, age 24-55, 2002 year.



APPENDIX IV. Results of Estimation.

Figure 11: Observed and Predicted distribution of log-wages. .

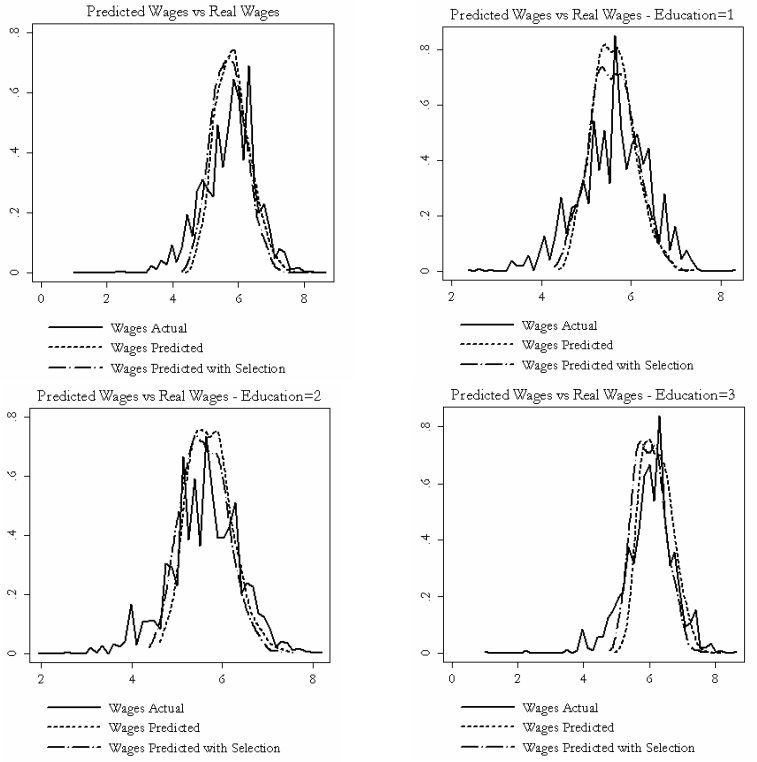


Figure 12. Predicted Probabilities of being employed for all, male and female populations.

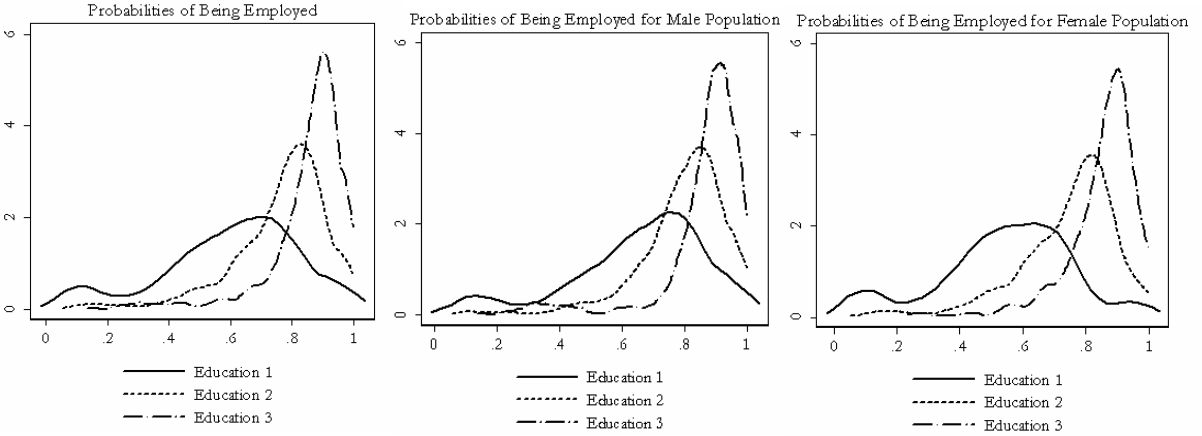


Figure 13. Predicted Probabilities of being employed depending on other family members' income.

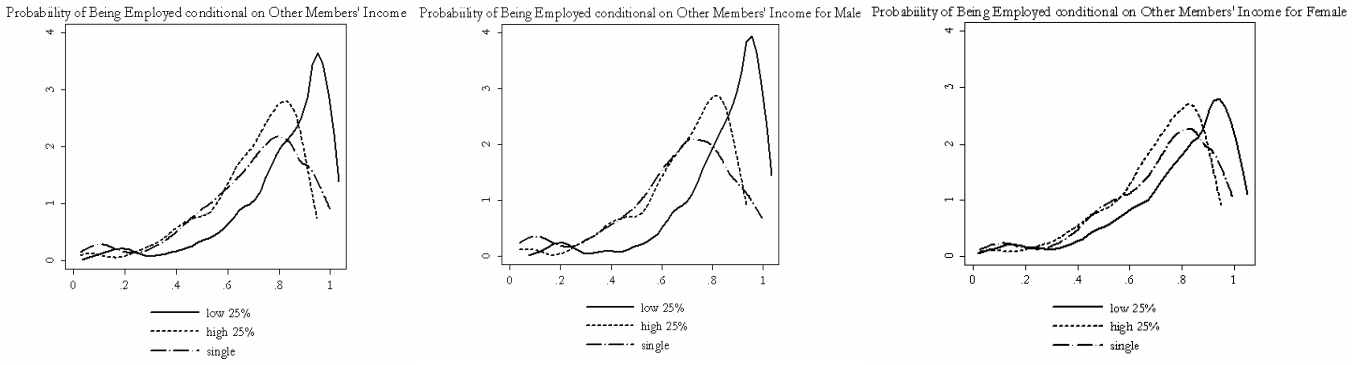


Figure 14. Predicted Probabilities of being employed in a particular occupational category for all, male and female populations by educational levels.

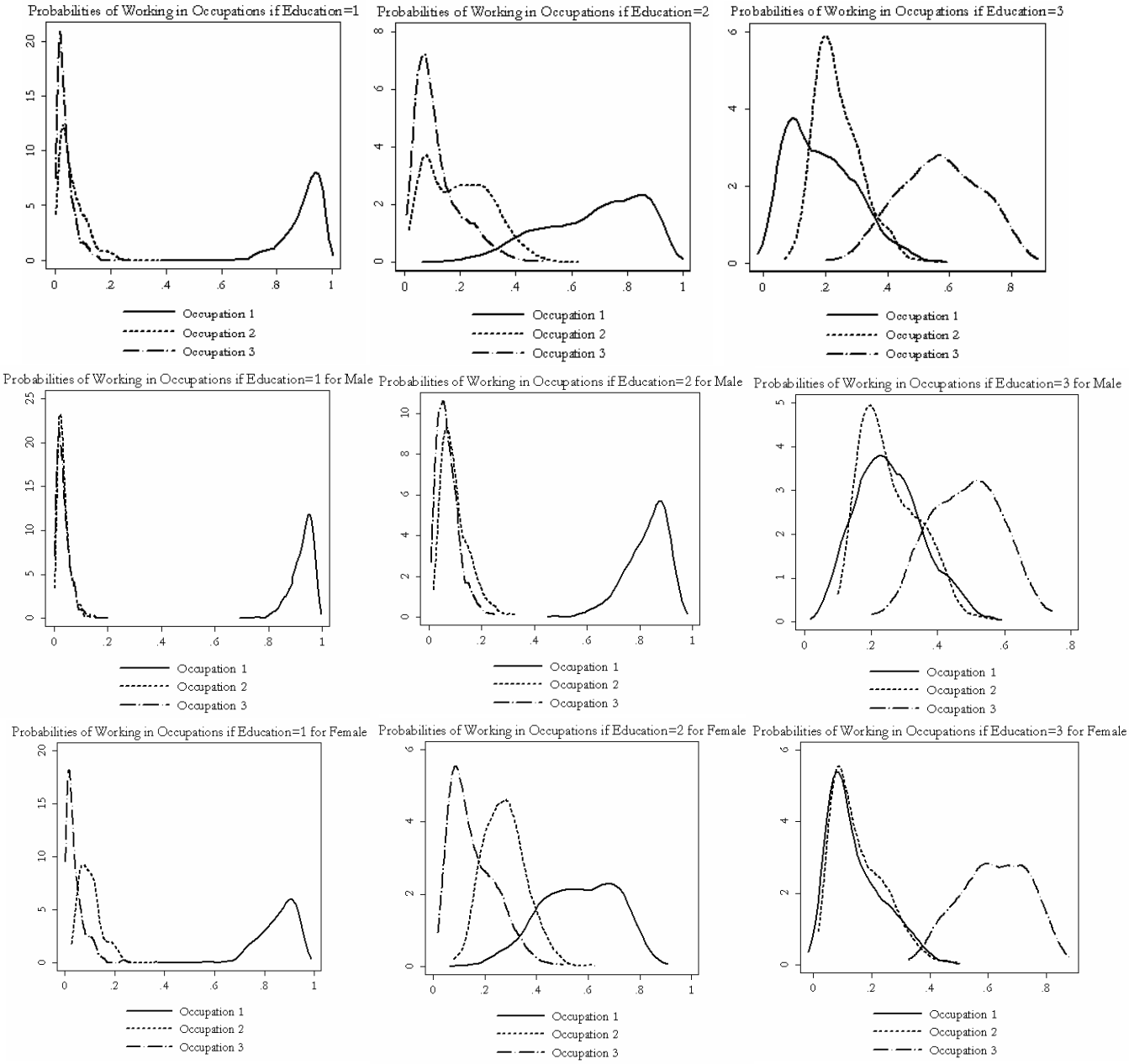


Figure 15. Predicted Probabilities of being employed in a particular occupational category for female populations by educational levels depending on other members' occupations.

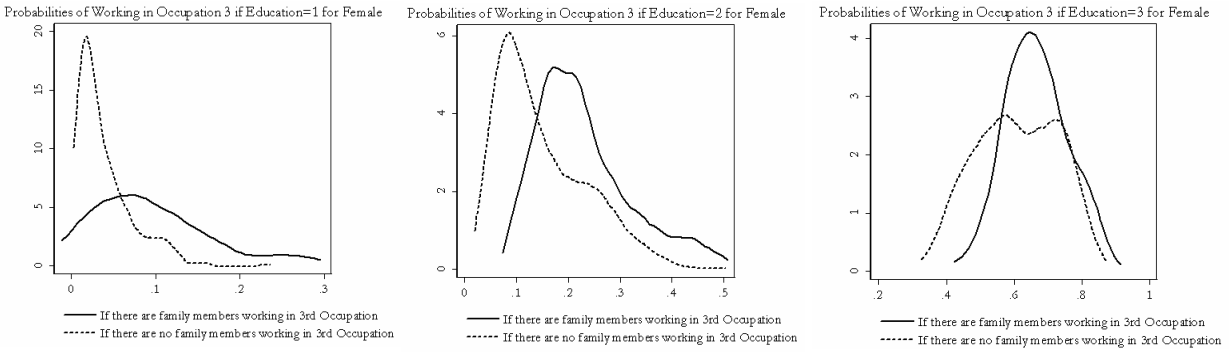


Figure 16. Predicted Probabilities of being employed in a particular occupational category by educational levels depending on other members' occupations.

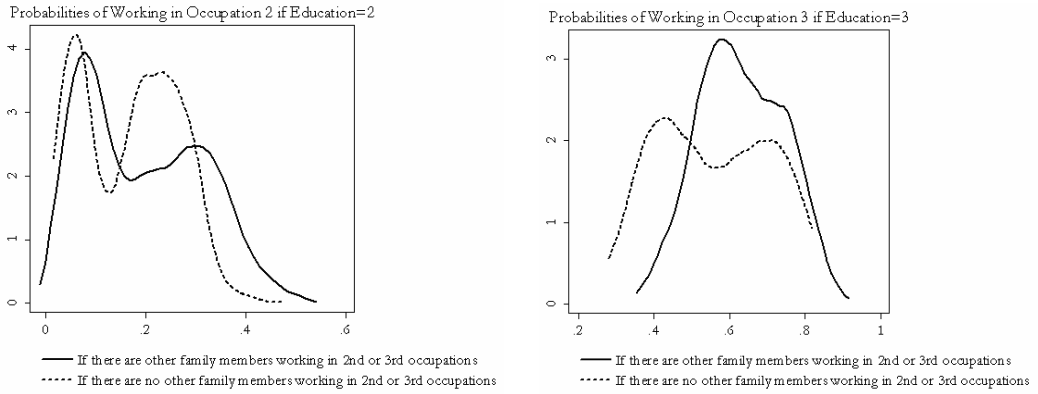


Figure 17. Predicted Probabilities of being employed in a particular occupational category by educational levels depending on Tenure.

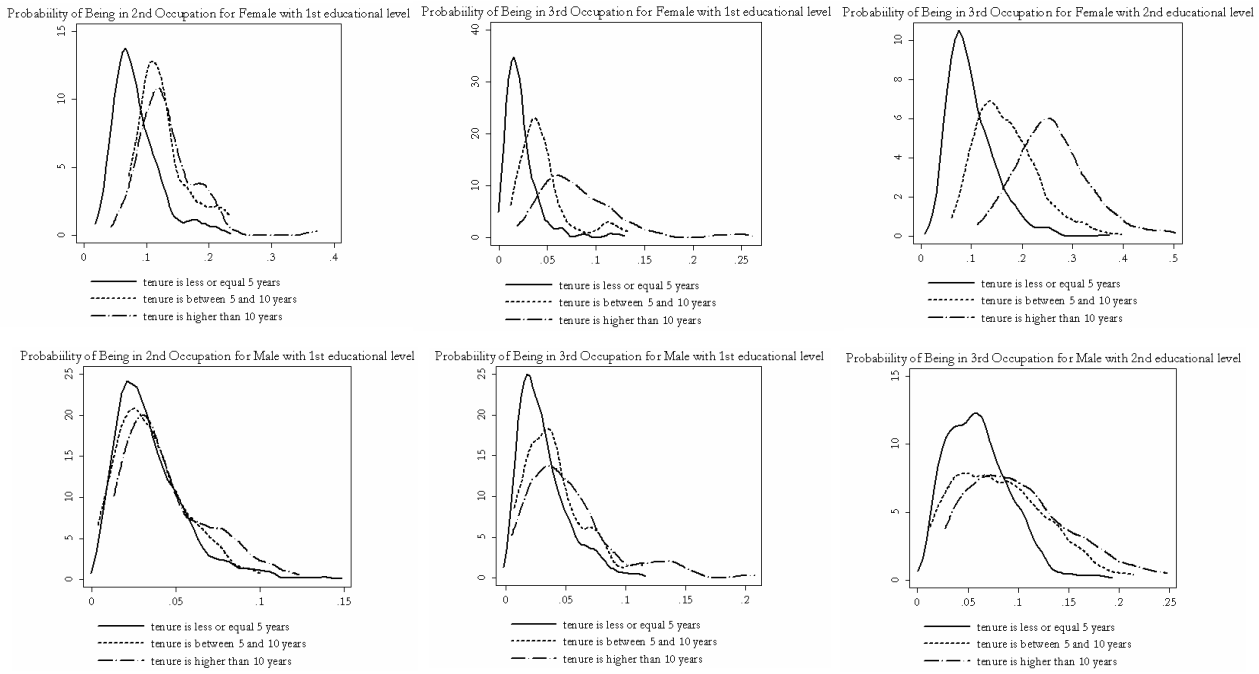


Figure 18. Predicted Probabilities of being employed in a particular occupational category by educational levels depending on Tenure.

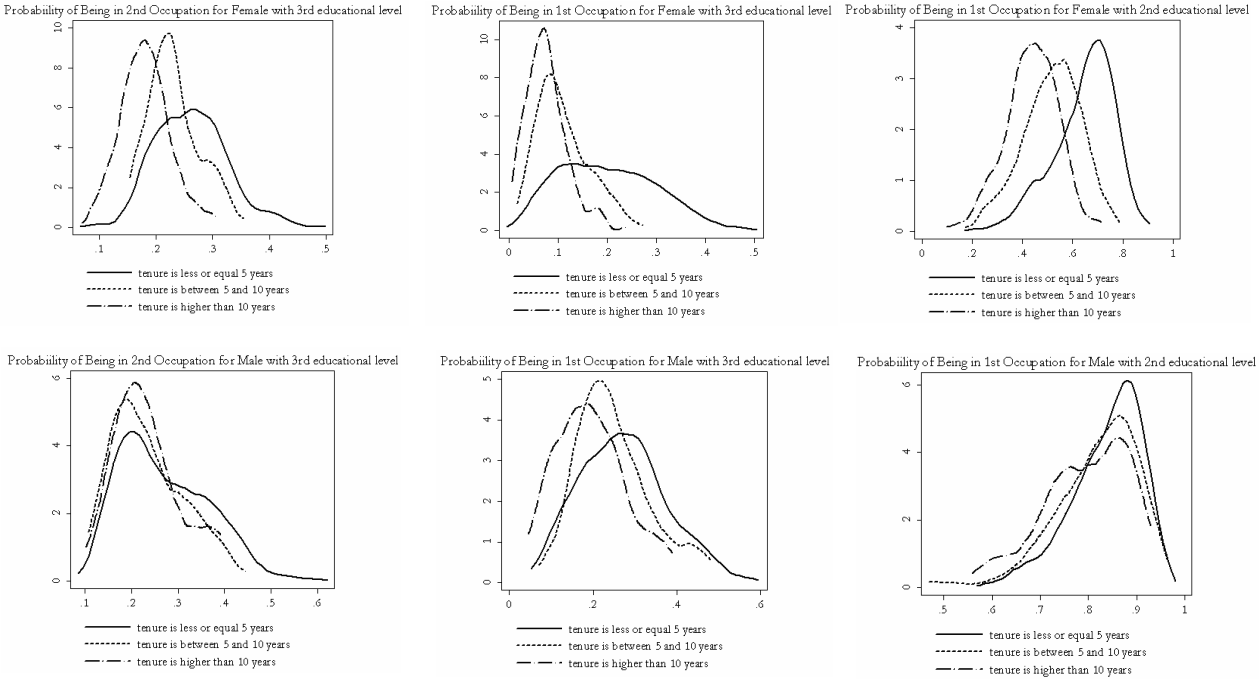
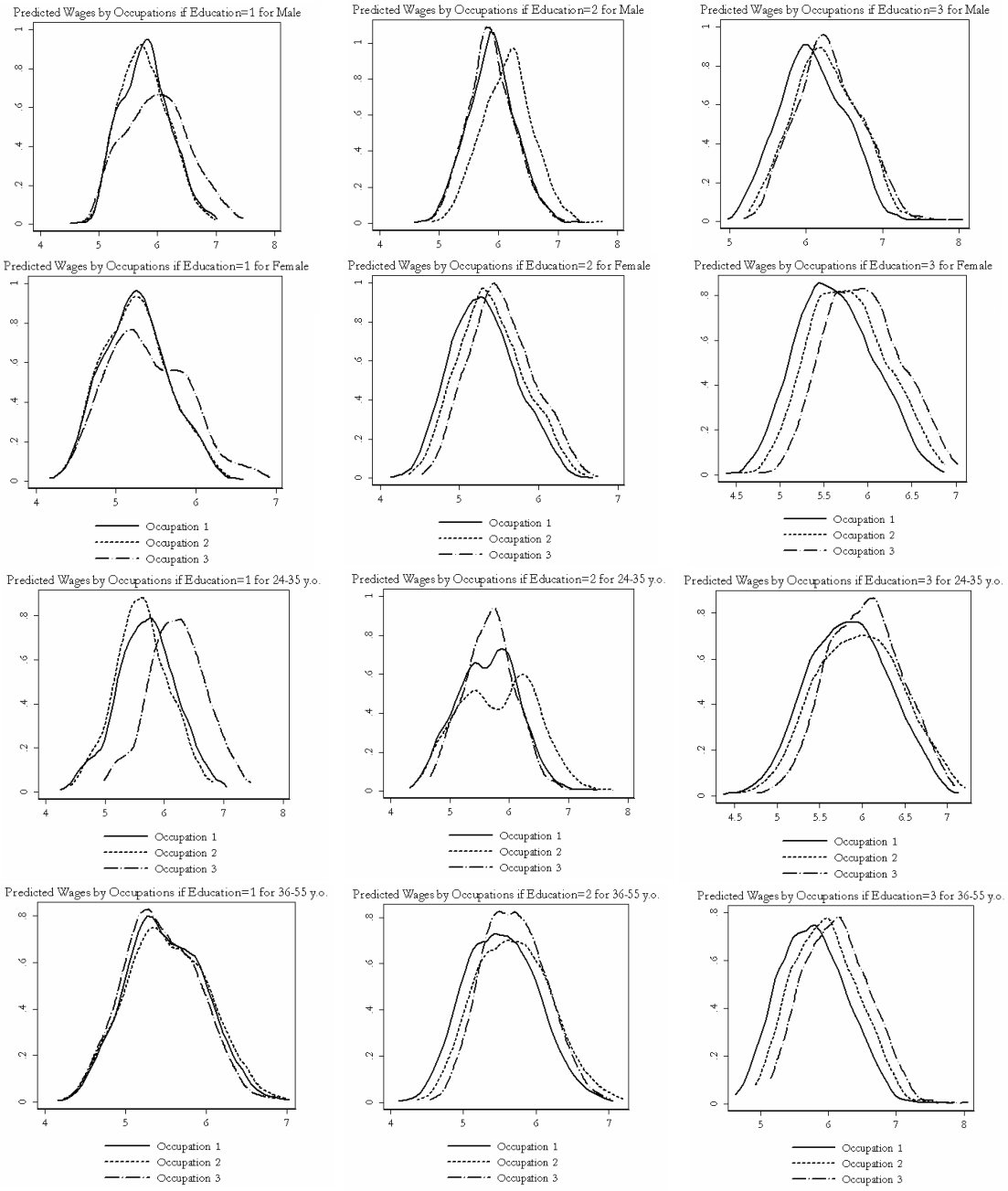


Figure 19. Predicted Wages in all occupational categories conditional on educational levels, sex and age.


Predicted Wages by Occupations if Education=1 for Male
Predicted Wages by Occupations if Education=2 for Male
Predicted Wages by Occupations if Education=3 for Male
Predicted Wages by Occupations if Education=1 for Female
Predicted Wages by Occupations if Education=2 for Female
Predicted Wages by Occupations if Education=3 for Female
Predicted Wages by Occupations if Education=1 for 24-35 y.o.
Predicted Wages by Occupations if Education=2 for 24-35 y.o.
Predicted Wages by Occupations if Education=3 for 24-35 y.o.
Predicted Wages by Occupations if Education=1 for 36-55 y.o.
Predicted Wages by Occupations if Education=2 for 36-55 y.o.
Predicted Wages by Occupations if Education=3 for 36-55 y.o.
Occupation 1
Occupation 2
Occupation 3

APPENDIX V. Instrumental Variable for Education.

Figure 20. Cohort Size, 1st Tertiary Education Admission, 2nd Tertiary Education Admission in the Years correspondent to the Year of Admission

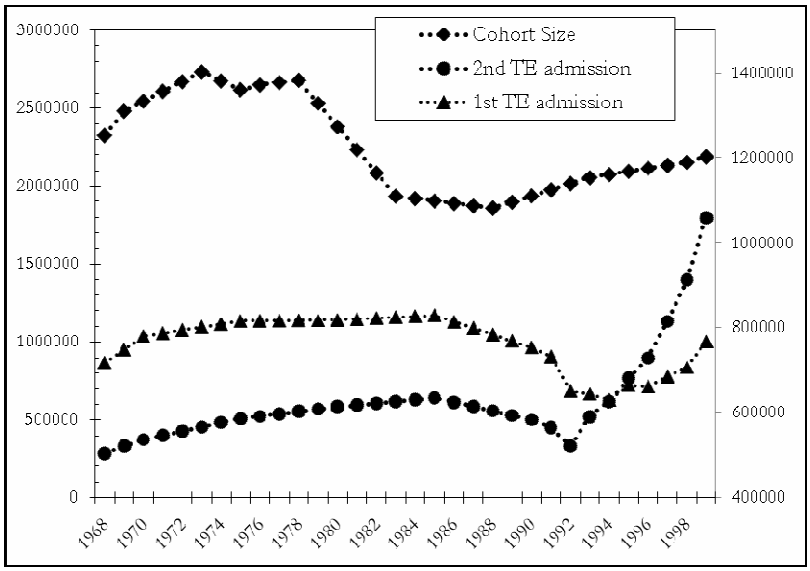
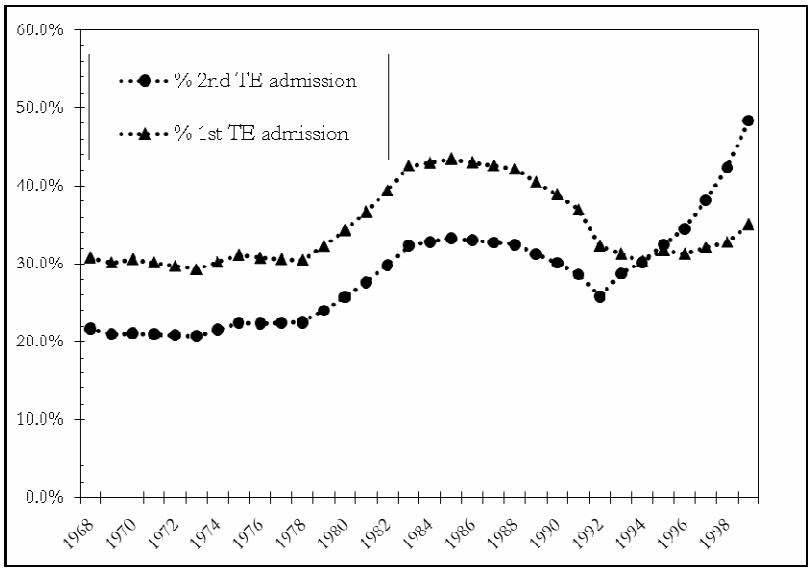


Figure 21. 1st Tertiary Education Admission, 2nd Tertiary Education Admission in the Years correspondent to the Year of Admission, % to the Size of Correspondent Cohort



APPENDIX I. Russian Federation: Educational System & Labour Market.

Table1. Russian population by educational levels: all, male and female population more than 15 year-olds

	Tertiary Education			Complete Secondary Education	Incomplete Secondary Education
	Complete 2nd level	Incomplete 2nd level	1st level		
All, 15+	16.2%	3.1%	27.4%	44.5%	8.8%
Male, 15+	15.8%	3.1%	25.3%	49.1%	6.7%
Female, 15+	16.5%	3.1%	29.2%	40.6%	10.5%

Source: General Census of the Russian population, 2002

Table 2: System of occupations and educational levels

International Standard Classification of Occupations[19]	Skill Level: ISCO /ISCED	Occupation Level: Equivalents in Russian Labour Force Structure	Skill Level: Equivalents in Russian Educational System
1) Legislators, Senior officials, Managers	-	1) Legislators, Senior officials, Managers	Tertiary Education: Higher Professional Education
2) Professionals	4th	2) Specialists with highest qualification	Tertiary Education: Higher Professional Education
3) Technicians and associate professionals	3rd	3) Specialists with middle level qualification	Tertiary Education: Post-Secondary Professional Education
4) Clerical and related workers	2nd	4) Clerical and related workers	Secondary Education
5) Service workers, shop and market sales workers	2nd	5) Service workers and shop and market sales workers	Secondary Education
6) Skilled agricultural and fishery workers	2nd	6) Skilled agricultural workers	Secondary Education
7) Craft and related trades workers	2nd	7) Qualified industrial workers	Secondary Education
8) Plant and machine operators and assemblers	2nd	8) Plant and machine operators and assemblers	Secondary Education
9) Elementary occupations	1st	9) Non-qualified workers	(Incomplete) Secondary Education
10) Armed forces	-	10) Armed forces	-

Table 3: Occupation Classification

ISCO Groups	Employed, %
TYPE: 3 (higher education required)	
1) Managers	6%
2) Professionals	15%
TYPE: 2 (post-secondary professional education)	
3) Associate professionals	17%
TYPE: 1 (secondary education required)	
4) Clerical workers	6%
5) Service workers	12%
7) Qualified workers	14%
8) Plant operators	17%
9) Non-qualified workers	12%
Other types:	
6) Agricultural workers	1%
10) Armed forces	1%
TOTAL % (*000)	100% (5420)

Source: RLMS databases (2005). Age 24-55

Table 4: Level of Education and Occupation classification according to ISCO, 2005

[19] International Standard Classification of Occupations (ISCO-1968/1988)

	TOTAL (age: 24-55)	Incomplete Secondary Education	Secondary Education	Post-Secondary Professional Education	Incomplete Higher Education (1-2 years of study)	Incomplete Higher Education (3-4 years of study)	Higher Education	Total
100%	Total=100%	6%	24%	43%	3%	2%	22%	100%
76%	Employed	53%	65%	79%	83%	80%	87%	76%
	Employed by Occupations							*100%*
	1-2	3,6%	4,0%	10,8%	19,5%	**30,3%**	**55,4%**	**21,3%**
	3	3,1%	7,8%	18,2%	**25,4%**	**28,0%**	**24,1%**	**17,4%**
	4-5, 7-9	**92,3%**	**87,0%**	**69,9%**	**40,9%**	**53,4%**	18,7%	**60,0%**
MALE (age: 24-55)								
100%	Total=100%	8%	26%	41%	3%	3%	19%	100%
78%	Employed	59%	70%	82%	84%	78%	88%	78%
	Employed by Occupations							*100%*
	1-2	4,2%	3,8%	7,2%	10,7%	17,3%	**46,7%**	**15,0%**
	3	2,5%	4,4%	7,2%	**23,2%**	**25,0%**	**24,1%**	**10,6%**
	4-5, 7-9	**91,7%**	**90,0%**	**83,6%**	**57,7%**	**62,5%**	24,6%	**71,9%**
FEMALE (age: 24-55)								
100%	Total=100%	5%	20%	45%	3%	2%	25%	100%
74%	Employed	45%	59%	76%	83%	81%	86%	74%
	Employed by Occupations							*100%*
	1-2	2,6%	4,3%	13,7%	**27,4%**	**38,8%**	**61,0%**	**26,9%**
	3	3,9%	12,8%	**27,3%**	**27,4%**	**30,0%**	**24,0%**	**23,4%**
	4-5, 7-9	**93,4%**	**82,6%**	**58,6%**	**30,0%**	**45,2%**	15,0%	**49,3%**

Source: RLMS database

Table 4B: Educational structure of employees in different types of occupation:

TOTAL (age: 24-55)	Incomplete Secondary Education	Secondary Education	Post-Secondary Professional Education	Incomplete Higher Education (1-2 years of study)	Incomplete Higher Education (3-4 years of study)	Higher Education
1-2	0,8%	3,8%	**22,6%**	2,5%	4,3%	**66,0%**
3	0,8%	8,7%	**46,7%**	3,9%	4,9%	**35,0%**
4-5, 7-9	6,9%	**28,6%**	**52,1%**	2,1%	2,4%	7,9%
MALE (age: 24-55)						
1-2	1,6%	6,9%	**20,8%**	1,9%	2,9%	**65,9%**
3	1,4%	9,7%	**29,2%**	5,9%	5,9%	**47,9%**
4-5, 7-9	7,4%	**31%**	**50,0%**	2,0%	2,4%	7,2%
FEMALE (age: 24-55)						
1-2	0,3%	2,4%	**23,6%**	2,7%	5,0%	**66,0%**
3	0,6%	8,3%	**53,8%**	3,1%	4,4%	**29,8%**
4-5, 7-9	6,2%	**25,6%**	**54,9%**	2,1%	2,4%	8,8%

APPENDIX II. The Russian Federation versus France: Occupational Placement and Wages Distribution.

Table 5: Educational Groups: Russian versus French Educational System.

Educational Level	Russian Educational System	French Educational System
Tertiary Education:		

4th level	2nd level of TE	Higher Professional Education	BAC+3 years and more: 2nd or 3rd cycle of universities, higher schools
3rd level	1st level of TE	Post-Secondary Professional Education	BAC+2 years: 1st cycle of universities & analogues
Secondary Education			
2nd level		Secondary Education	BAC diploma: General or Technological Baccalaureate & analogues
Primary or No Education			
1st level		Incomplete Secondary Education	No BAC diploma

Educational Level	Russia			France		
	ALL	**FEMALE**	**MALE**	**ALL**	**FEMALE**	**MALE**
	100%	*100%*	*100%*	*100%*	*100%*	*100%*
4th	23%	29%	21%	13%	14%	12%
3rd	51%	52%	49%	14%	17%	12%
2nd & 1st	26%	19%	30%	73%	69%	76%

Table 6: Occupational Categories: Russian versus French Labour Market.

Occupational Level	Russian Labour Market	French Labour Market
Type 3	**22%**	**14%**
(2nd level of Tertiary Education is required):	Managers	Supervisor
	Professionals	Line Supervisor & Technician
Type 2	**18%**	**24%**
(1st level of Tertiary Education is required):	Associate professionals	Middle-level white collar
Type 1	**61%**	**62%**
(Secondary Education or less is required)	Clerical workers	Low-level white collar
	Service workers	Qualified blue collar
	Qualified workers	Non qualified blue collar
	Plant operators	
	Non-qualified workers	

Table 7: Occupational Placement according to educational levels: Russia versus France.

Occupation level/ Educational level	Russia	France
Occupation: Type 3		
Education: 4th level	66%	60%
Education: 3rd level	30%	17%
Education: 2nd level	3%	11%
Education: 1st level	1%	11%
Occupation: Type 2		
Education: 4th level	35%	14%
Education: 3rd level	56%	34%
Education: 2nd level	8%	20%
Education: 1st level	1%	30%
Occupation: Type 1		
Education: 4th level	8%	2%
Education: 3rd level	56%	6%
Education: 2nd level	25%	14%
Education: 1st level	7%	78%

	Russia		France	
	Female	**Male**	**Female**	**Male**
Education: 4th				
Occupation: 3rd	61%	46%	55%	76%
Occupation: 2nd	24%	24%	32%	18%
Occupation: 1st	15%	24%	13%	6%
Education: 3rd				
Occupation: 3rd	14%	7%	11%	27%
Occupation: 2nd	27%	7%	60%	53%
Occupation: 1st	59%	84%	30%	20%
Education: 2nd				
Occupation: 3rd	4%	4%	6%	15%
Occupation: 2nd	13%	4%	28%	37%
Occupation: 1st	83%	90%	65%	48%
Education: 1st				
Occupation: 3rd	3%	4%	5%	4%
Occupation: 2nd	4%	3%	21%	17%
Occupation: 1st	93%	93%	74%	79%

APPENDIX III. Data Description.

Table 8.1: Explanatory Variables for the System of Equations

Groups	Explanatory Variables	EQUATIONS:			
		Education	**Employment**	**Occupation**	**Wage**
Education: Maximal level obtained.	–secondary education*		+	+	+
	– complete tertiary education 1st level*		+	+	+
	– complete tertiary education 2nd level*		+	+	+
Characteristics of	– student ratio (in all population) in the period	+			

Educational System (in the period of 18 years old of population)	corresponding to 18 years old – graduation rate 3rd educational level (in the period corresponding to 18 years old) – graduation rate 2nd educational level (in the period corresponding to 18 years old)	 + +			
Personal characteristics.	– sex* – age – living in Russia since the birth*	+ + +	+	+ +	+ +
Personal characteristics: Health & Sport Attendance.	– disabled workers* – presence of chronic diseases* – been operated during last year* – smoking* – alcohol consumers with often frequency* – sport activities during last year at least 12 times* – executes physical training at least 3 times every week* – not execute any physical trainings or gymnastics*			 + + + + +	+ + +
Household characteristics: General.	– living in a household/family* – number of household members* – presence of kids in a family less than 3 years old* – presence of kids in a family 4-7 years old* – presence of kids in a family 8- 18 years old* – maximal education level of other household members* (3rd, 2nd, 1st) – maximal occupational level of other household members* (3rd, 2nd, 1st)	 + 	+ + + + 	+ +	
Household characteristics: Activities.	– using a land* – stock farming* – selling produced agricultural products* – renting or farming activities*		+ + + +		
Household characteristics: Finance.	– monthly income earned from home production – monthly income earned by others household members divided by the number of household members		+ +		
Labour Market Characteristics	– regional unemployment rate (by 39 regions)		+		
Regional characteristics.	– types of a region of residence (village, city type village, town, city)* – 7 federal districts*, two federal cities (Moscow and Saint Petersburg)* and Moscow Region*	+ +	+ +	+ +	+ +
Job characteristics	– experience at a current working place (tenure) – estimated experience after 18 years old (age – time spent on education) – number of hours worked during last month – ownership status of an enterprise (state capital, foreign capital, Russian private capital, individual business)* – type of industry (17 industrial types)* – presence* and number of subordinates – job considered as a danger work*			+ +	+ + + + + + +

* dummy variables

Table 8.2: Summary Statistics of Dependent and Explanatory Variables:

		ALL				FEMALE			MALE		
	Variable	**Obs**	**Mean**	**StDev**	**Min**	**Max**	**Obs**	**Mean**	**StDev**	**Obs**	**Mean**	**StDev**
ALL POPULATION		**4769**					**2612**			**2157**		
	AGE											
1	age	4769	38.97	9.27	24	55	2612	39.50	9.31	2157	38.34	9.17
	SEX											
2	Male * (Female – reference category)	4769	0.45	0.50	0	1	2612			2157		
	EDUCATION											
	Incomplete secondary education* *(reference category)*											
	Complete Secondary Education *	4769	0.30	0.46	0	1	2612	0.24	0.43	2157	0.36	0.48
	Post-secondary Professional Education *	4769	0.49	0.50	0	1	2612	0.51	0.50	2157	0.46	0.50

Higher Education *	4769	0.22	0.41	0	1	2612	0.25	0.43	2157	0.18	0.39
HOUSEHOLD CHARACTERISTICS											
Living in family / household *	4769	0.75	0.43	0	1	2612	0.70	0.46	2157	0.81	0.39
Presence of kids in the family 0-3 y.o *	4769	0.11	0.31	0	1	2612	0.08	0.27	2157	0.14	0.34
Presence of kids in the family 4-7 y.o *	4769	0.14	0.35	0	1	2612	0.14	0.34	2157	0.15	0.36
Presence of kids in the family 8-18 y.o *	4769	0.39	0.49	0	1	2612	0.42	0.49	2157	0.35	0.48
Use of land in household *	4769	0.52	0.50	0	1	2612	0.52	0.50	2157	0.52	0.50
Stock farming in household *	4769	0.19	0.39	0	1	2612	0.19	0.39	2157	0.20	0.40
Selling agricultural products *	4769	0.10	0.30	0	1	2612	0.09	0.29	2157	0.10	0.31
Income from home production	4769	0.48	1.55	0	10.05	2612	0.45	1.51	2157	0.51	1.60
Income of others people in family divided by n	4769	4.52	1.48	0	9.33	2612	4.64	1.43	2157	4.37	1.52
Maximal educational level of other family members = 1 *	4769	0.17	0.37	0	1	2612	0.19	0.39	2157	0.15	0.36
Maximal educational level of other family members = 2 *	4769	0.37	0.48	0	1	2612	0.34	0.47	2157	0.40	0.49
Maximal educational level of other family members = 3 *	4769	0.09	0.29	0	1	2612	0.09	0.28	2157	0.09	0.29
Maximal educational level of other family members = 4 *	4769	0.22	0.42	0	1	2612	0.20	0.40	2157	0.25	0.43
Maximal occupational level of other family members = 1 *	4769	0.40	0.49	0	1	2612	0.44	0.50	2157	0.36	0.48
Maximal occupational level of other family members = 2 *	4769	0.13	0.34	0	1	2612	0.10	0.30	2157	0.17	0.38
Maximal occupational level of other family members = 3 *	4769	0.16	0.36	0	1	2612	0.12	0.33	2157	0.19	0.40
Other activities: renting, farming *	4769	0.02	0.13	0	1	2612	0.02	0.13	2157	0.01	0.11
EDUCATIONAL SYSTEM CHARACTERISTICS											
graduation rate, 3rd educational level	4769	0.69	0.07	0.52	0.82	2612	0.69	0.07	2157	0.69	0.07
graduation rate, 2nd educational level	4769	0.53	0.05	0.43	0.64	2612	0.52	0.05	2157	0.53	0.04
students rate, 3rd & 2nd educational levels	4769	0.99	0.09	0.79	1.26	2612	0.99	0.09	2157	0.99	0.09
REGION CHARACTERISTICS											
Village *(reference category)*											
Village city type	4769	0.06	0.25	0	1	2612	0.07	0.25	2157	0.06	0.24
Town	4769	0.28	0.45	0	1	2612	0.28	0.45	2157	0.28	0.45
City	4769	0.40	0.49	0	1	2612	0.40	0.49	2157	0.39	0.49
Moscow *	4769	0.08	0.27	0	1	2612	0.08	0.27	2157	0.08	0.28
Moscow Region *	4769	0.04	0.18	0	1	2612	0.04	0.19	2157	0.03	0.18
Saint Petersburg *	4769	0.04	0.18	0	1	2612	0.04	0.19	2157	0.03	0.18
Central Region *	4769	0.13	0.34	0	1	2612	0.13	0.34	2157	0.13	0.34
South Region *	4769	0.18	0.38	0	1	2612	0.17	0.38	2157	0.19	0.39
North West Region *	4769	0.06	0.24	0	1	2612	0.06	0.25	2157	0.06	0.24
Far East Region *	4769	0.06	0.24	0	1	2612	0.07	0.25	2157	0.06	0.23
Siberia Region *	4769	0.12	0.33	0	1	2612	0.12	0.32	2157	0.12	0.33
Volga Region *(reference category)*											
Ural Region *(reference category)*											
Unemployment rate (on regional level, 39 regions)	4769	7.88	4.31	0.80	23.40	2612	7.84	4.20	2157	7.93	4.44
Living in Russia from birth *	4769	0.92	0.27	0	1	2612	0.92	0.27	2157	0.92	0.28
HEALTH & SPORT											
Disabled Worker *	4769	0.05	0.21	0	1	2612	0.04	0.20	2157	0.05	0.22
Chronic diseases *	4769	0.44	0.50	0	1	2612	0.49	0.50	2157	0.38	0.49
Being operated last year *	4769	0.03	0.17	0	1	2612	0.04	0.19	2157	0.02	0.15
Smoking *	4769	0.43	0.50	0	1	2612	0.22	0.41	2157	0.69	0.46
Alcohol drinker: often *	4769	0.04	0.19	0	1	2612	0.01	0.12	2157	0.07	0.26
Sport activities during last year *	4769	0.10	0.30	0	1	2612	0.09	0.29	2157	0.11	0.32
Sport frequency: often *	4769	0.05	0.22	0	1	2612	0.04	0.21	2157	0.06	0.24
Sport frequency: never *	4769	0.83	0.37	0	1	2612	0.84	0.37	2157	0.83	0.38
WORK CHARACTERISTICS											
Unemployed *(reference category)*											
Employed*	4769	0.74	0.44	0	1	2612	0.72	0.45	2157	0.76	0.43
ONLY EMPLOYED POPULATION	**3510**					**1880**			**1630**		
EDUCATION											
Incomplete secondary education* *(reference category)*											
Complete Secondary Education *	3510	0.24	0.43	0	1	1880	0.18	0.39	1630	0.31	0.46
Post-secondary Professional Education *	3510	0.50	0.50	0	1	1880	0.52	0.50	1630	0.48	0.50
Higher Education *	3510	0.25	0.44	0	1	1880	0.30	0.46	1630	0.21	0.41

OCCUPATIONAL CATEGORIES											
Occupation 1: 4,5,7,8,9 types	**2133**					**929**			**1204**		
Occupation 2: 3rd types	**623**					**437**			**186**		
Occupation 3: 1, 2 types	**754**					**514**			**240**		
WAGE											
Logariphm of wage	3510	5.71	0.81	1.03	8.63	1880	5.50	0.77	1630	5.95	0.79
Logariphm of wage within Occupation 1	2133	5.63	0.78	1.98	8.16	929	5.36	0.73	1204	5.85	0.75
Logariphm of wage within Occupation 2	623	5.72	0.84	2.22	8.12	437	5.48	0.77	186	6.27	0.74
Logariphm of wage within Occupation 3	754	5.91	0.82	1.03	8.63	514	5.76	0.76	240	6.24	0.84
EXPERIENCE & TENURE & HOURS WORKED											
Estimated experience (age - education) after 18 y.o.	3510	18.15	9.19	0	37	1880	18.45	9.19	1630	17.81	9.17
Square of Estimated experience	3510	413.8	347.10	0	1369	1880	424.73	347.19	1630	401.24	346.68
Experience at current job (tenure)	3510	6.90	7.89	0	38	1880	7.98	8.48	1630	5.66	6.95
Square of Tenure	3510	109.91	215.38	0	1444	1880	135.51	237.34	1630	80.39	182.54
Number of Hours worked	3510	171.91	48.74	4	432	1880	161.24	42.94	1630	184.23	52.03
ENTREPRISE TYPE											
State Capital *	3510	0.50	0.50	0	1	1880	0.57	0.50	1630	0.43	0.50
Foreign Capital *	3510	0.04	0.20	0	1	1880	0.03	0.17	1630	0.05	0.22
Russian Private Capital *	3510	0.46	0.50	0	1	1880	0.40	0.49	1630	0.53	0.50
Individual Business *	3510	0.05	0.21	0	1	1880	0.04	0.19	1630	0.05	0.22
INDUSTRY											
Industry 1: light or food industry *	3506	0.07	0.26	0	1	1879	0.07	0.26	1627	0.07	0.26
Industry 2: machinery and engineering *	3506	0.04	0.19	0	1	1879	0.03	0.17	1627	0.04	0.20
Industry 3: military-industrial complex *	3506	0.02	0.14	0	1	1879	0.02	0.14	1627	0.02	0.15
Industry 4: oil and gas industry *	3506	0.02	0.15	0	1	1879	0.01	0.12	1627	0.04	0.18
Industry 5: others parts of heavy industry *	3506	0.03	0.16	0	1	1879	0.02	0.13	1627	0.04	0.19
Industry 6: construction *	3506	0.08	0.28	0	1	1879	0.03	0.18	1627	0.15	0.35
Industry 7: transport, communication *	3506	0.10	0.31	0	1	1879	0.07	0.26	1627	0.14	0.35
Industry 8: agriculture *	3506	0.05	0.21	0	1	1879	0.03	0.18	1627	0.06	0.24
Industry 9: machinery of government *	3506	0.02	0.14	0	1	1879	0.03	0.17	1627	0.01	0.10
Industry 10: education *	3506	0.09	0.29	0	1	1879	0.16	0.36	1627	0.02	0.15
Industry 11: science, culture *	3506	0.02	0.15	0	1	1879	0.03	0.18	1627	0.01	0.12
Industry 12: public health service *	3506	0.07	0.26	0	1	1879	0.12	0.32	1627	0.03	0.16
Industry 13: army, defence, security services *	3506	0.05	0.21	0	1	1879	0.02	0.15	1627	0.07	0.26
Industry 14: trade and consumer services *	3506	0.16	0.37	0	1	1879	0.20	0.40	1627	0.13	0.33
Industry 15: finance *	3506	0.02	0.14	0	1	1879	0.03	0.17	1627	0.01	0.08
Industry 16: energy industry *	3506	0.02	0.15	0	1	1879	0.02	0.13	1627	0.03	0.17
Industry 17: housing and communal services *	3506	0.04	0.21	0	1	1879	0.03	0.18	1627	0.06	0.23
Natural Resources * (Industries: 4, 16)	3510	0.05	0.21	0	1	1880	0.03	0.18	1630	0.07	0.25
Commercial Service Industries * (Industries: 6, 7, 14, 15)	3510	0.37	0.48	0	1	1880	0.33	0.47	1630	0.42	0.49
Industry * (Industries: 1, 2, 5)	3510	0.14	0.34	0	1	1880	0.12	0.33	1630	0.15	0.36
Publis Services * (Industries: 3, 8, 9, 10, 11, 12, 13, 17)	3510	0.37	0.48	0	1	1880	0.45	0.50	1630	0.29	0.45
OTHER											
Presence of subordinates *	3510	0.23	0.42	0	1	1880	0.21	0.41	1630	0.24	0.43
Sum of subordinates	3510	6.34	102.86	0	5000	1880	2.59	11.80	1630	10.67	150.31
Job characteristic: danger work *	3510	0.15	0.36	0	1	1880	0.13	0.33	1630	0.17	0.38
Not-working period due to malady *	3510	0.06	0.24	0	1	1880	0.06	0.23	1630	0.06	0.24

APPENDIX IV. Results of Estimation.

Table 10: Selection Model Estimation with exogenous distribution among occupational categories.

Selection Model (correction on labour market participation bias) with exogenous occupational choice

Educational Variables	1st specification	2nd specification	3rd specification		
			1st Occupation	2nd Occupation	3rd Occupation
MALE 24-35					
1st educational level *	0.156*	0.154*	0.160**	0.008	0.734***
	(0.080)	(0.080)	(0.081)	(0.219)	(0.261)

2nd educational level *	0.197**	0.173**	0.160*	0.521***	0.118
	(0.087)	(0.086)	(0.088)	(0.161)	(0.204)
3rd educational level *	0.250**	0.149	0.190	0.375**	0.320*
	(0.104)	(0.104)	(0.132)	(0.169)	(0.174)
MALE 36-55					
2nd educational level *	0.033	0.015	0.011	0.220	0.089
	(0.053)	(0.052)	(0.053)	(0.165)	(0.173)
3rd educational level *	0.243***	0.130*	0.051	0.191	0.416***
	(0.071)	(0.070)	(0.105)	(0.152)	(0.155)
FEMALE 24-35					
1st educational level *	0.149*	0.170*	0.140	0.144	0.670
	(0.089)	(0.088)	(0.091)	(0.245)	(0.453)
2nd educational level *	0.094	0.065	0.069	0.076	0.278
	(0.086)	(0.084)	(0.089)	(0.137)	(0.174)
3rd educational level *	0.518***	0.410***	0.357***	0.429***	0.658***
	(0.103)	(0.099)	(0.133)	(0.153)	(0.167)
FEMALE 36-55					
2nd educational level *	0.090	0.052	0.007	0.131	0.336**
	(0.060)	(0.056)	(0.062)	(0.119)	(0.151)
3rd educational level *	0.460***	0.334***	0.185	0.374***	0.592***
	(0.075)	(0.071)	(0.119)	(0.134)	(0.149)
2nd occupational type		0.132***		0.029	
		(0.032)		(0.112)	
3rd occupational type		0.224***			-0.028
		(0.036)			(0.136)
male*	0.416**	0.432**	0.360**	0.360**	0.360**
	(0.185)	(0.182)	(0.183)	(0.183)	(0.183)
constant	4.587***	4.548***	4.593***		
	(0.188)	(0.168)	(0.170)		
Observations	4769				

Standard errors in parentheses
* significant at 10%; ** significant at 5%; *** significant at 1%

Table 11: Estimation Results of Reduced-Form Joint Model of Educational Choice, Labour Market Participation, Occupational Choice and Wages.

VARIABLES	Employment Occupation Wage	Education (IV: 1) Employment Occupation Wage	Education (IV: 2) Employment Occupation Wage	Education (IV: 1&2) Employment Occupation Wage
EQUATION OF EDUCATIONAL CHOICE				
Age & Sex				
male* (female - reference category)		-0.725***	-0.892***	-0.868***
		(0.141)	(0.146)	(0.146)
age*male		0.002	0.003	-0.006
		(0.003)	(0.003)	(0.004)
age*female		-0.010***	-0.011***	-0.019***
		(0.003)	(0.002)	(0.004)
Educational System Characteristics				
graduation rate,		0.279		1.260***
3rd educational level		(0.332)		(0.414)
graduation rate,		0.713		-1.039
2nd educational level		(0.481)		(0.664)
students rate,		0.489***		0.667***
3rd & 2nd educational levels		(0.177)		(0.226)
Education of Household Members				
maximal Level of Education==1			-0.264***	-0.268***
(secondary)*			(0.058)	(0.058)
maximal Level of Education==2			0.048	0.045
(1st level of tertiary)*			(0.050)	(0.051)

maximal Level of Education==4			0.339***	0.339***
(2nd level of tertiary complete)*			(0.068)	(0.069)
maximal Level of Education==3			0.775***	0.780***
(2nd level of tertiary incomplete)*			(0.055)	(0.055)
Regional Characteristics				
city* (small villages - reference category)	0.720***		0.565***	0.564***
	(0.050)		(0.052)	(0.052)
town* (small villages - reference category)	0.449***		0.386***	0.385***
	(0.049)		(0.050)	(0.050)
village* (small villages - reference category)	0.226***		0.226***	0.225***
	(0.064)		(0.072)	(0.072)
Moscow *	0.017		-0.063	-0.062
	(0.068)		(0.069)	(0.069)
Moscow region *	0.490***		0.470***	0.477***
	(0.097)		(0.099)	(0.099)
Saint Petersburg *	0.018		-0.001	-0.010
	(0.092)		(0.094)	(0.094)
Central region *	0.034		0.068	0.071
	(0.058)		(0.060)	(0.060)
South region *	-0.003		-0.057	-0.057
	(0.054)		(0.055)	(0.055)
North-West region *	0.072		0.094	0.094
	(0.076)		(0.077)	(0.077)
Far-East region *	0.108		0.077	0.081
	(0.074)		(0.074)	(0.075)
Siberia region *	0.064		0.091	0.093
	(0.058)		(0.058)	(0.058)
Individual Characteristics				
living in Russia from birth *	-0.137**		-0.124**	-0.121*
	(0.059)		(0.062)	(0.062)
Constant	-0.313		0.765***	0.073
	(0.354)		(0.130)	(0.441)

EQUATION OF LABOUR MARKET PARTICIPATION

Age & Sex				
male * *(female – reference category)*	0.010	0.168	0.083	0.084
	(0.141)	(0.144)	(0.144)	(0.144)
Individual Characteristics				
3rd educational level * • male*	0.595***	1.841***	1.219***	1.241***
	(0.105)	(0.317)	(0.210)	(0.207)
2nd educational level * • male*	0.266***	0.867***	0.568***	0.578***
	(0.073)	(0.165)	(0.119)	(0.118)
3rd educational level * • female*	0.810***	1.992***	1.396***	1.416***
	(0.085)	(0.315)	(0.202)	(0.199)
2nd educational level * • female*	0.432***	1.000***	0.705***	0.714***
	(0.067)	(0.158)	(0.112)	(0.111)
experience (predicted, 18+) • male*	-0.009**	-0.010***	-0.011***	-0.011***
	(0.004)	(0.004)	(0.004)	(0.004)
experience (predicted, 18+) • female*	-0.013***	-0.009**	-0.012***	-0.012***
	(0.003)	(0.004)	(0.003)	(0.003)
Household Characteristics				
living in a family *	0.269***	0.247***	0.256***	0.256***
	(0.050)	(0.050)	(0.052)	(0.052)
using land *	0.110**	0.106**	0.100**	0.099**
	(0.049)	(0.045)	(0.049)	(0.049)
stock farming *	-0.283***	-0.211***	-0.217***	-0.218***
	(0.067)	(0.064)	(0.069)	(0.069)
selling agricultural products *	-0.375**	-0.460**	-0.539***	-0.542***
	(0.188)	(0.181)	(0.196)	(0.196)
revenues from home production	0.041	0.064*	0.078**	0.078**
	(0.037)	(0.035)	(0.038)	(0.038)
ln of other members income	-0.257***	-0.253***	-0.281***	-0.280***
	(0.025)	(0.029)	(0.026)	(0.026)
other activities *	-0.123	-0.205	-0.186	-0.189
	(0.139)	(0.135)	(0.143)	(0.143)
kids: 0-3 years old * • male*	0.067	0.020	0.011	0.015
	(0.109)	(0.101)	(0.111)	(0.111)
kids: 4-7 years old * • male*	0.026	0.042	0.040	0.041
	(0.101)	(0.094)	(0.103)	(0.102)

kids: 8-18 years old * • male*	0.164**	0.162**	0.168**	0.160**
	(0.070)	(0.067)	(0.071)	(0.071)
kids: 0-3 years old * • female*	-0.727***	-0.725***	-0.795***	-0.788***
	(0.098)	(0.102)	(0.100)	(0.100)
kids: 4-7 years old * • female*	-0.281***	-0.271***	-0.281***	-0.277***
	(0.087)	(0.084)	(0.089)	(0.089)
kids: 8-18 years old * • female*	0.020	0.007	0.028	0.022
	(0.055)	(0.052)	(0.056)	(0.056)
Regional Characteristics				
city* *(small villages - reference category)*	0.349***	0.177	0.361***	0.356***
	(0.070)	(0.124)	(0.091)	(0.090)
town* *(small villages - reference category)*	0.409***	0.236**	0.362***	0.358***
	(0.068)	(0.096)	(0.078)	(0.078)
village* *(small villages - reference category)*	-0.195**	-0.248***	-0.214**	-0.214**
	(0.088)	(0.092)	(0.095)	(0.095)
Moscow *		-0.494***	-0.496***	-0.497***
		(0.105)	(0.109)	(0.109)
Moscow region *		-0.246*	-0.127	-0.132
		(0.134)	(0.133)	(0.133)
Saint Petersburg *		-0.534***	-0.549***	-0.549***
		(0.127)	(0.131)	(0.131)
Central region *		-0.136*	-0.127*	-0.127*
		(0.070)	(0.073)	(0.073)
South region *		-0.069	-0.063	-0.062
		(0.066)	(0.069)	(0.069)
North-West region *		0.323***	0.366***	0.365***
		(0.100)	(0.102)	(0.102)
Far-East region *		0.103	0.141	0.139
		(0.091)	(0.093)	(0.093)
Siberia region *		0.009	0.015	0.015
		(0.073)	(0.076)	(0.076)
Labour Market Characteristics				
unemployment rate (on regional level)	-0.051***	-0.071***	-0.074***	-0.074***
	(0.006)	(0.008)	(0.007)	(0.007)
Constant	1.769***	1.390***	1.818***	1.807***
	(0.173)	(0.308)	(0.199)	(0.199)

EQUATION OF OCCUPATIONAL CHOICE
OCCUPATION GROUP 2

Sex				
male * *(female – reference category)*	-0.100	-0.594**	-0.069	-0.068
	(0.388)	(0.248)	(0.397)	(0.397)
Individual Characteristics				
3rd educational level * • male*	2.162***	-1.885***	2.604***	2.612***
	(0.202)	(0.463)	(0.407)	(0.403)
2nd educational level * • male*	0.652***	-1.219***	0.900***	0.905***
	(0.180)	(0.230)	(0.268)	(0.266)
3rd educational level * • female*	1.755***	-2.144***	2.182***	2.188***
	(0.184)	(0.415)	(0.400)	(0.397)
2nd educational level * • female*	1.018***	-1.015***	1.245***	1.249***
	(0.155)	(0.238)	(0.241)	(0.240)
experience (predicted, 18+) • male*	-0.070**	-0.034	-0.068**	-0.070**
	(0.033)	(0.022)	(0.033)	(0.033)
experience (predicted, 18+) • female*	-0.037	-0.029*	-0.041*	-0.043*
	(0.024)	(0.017)	(0.025)	(0.025)
sq. experience (predicted, 18+) • male*/100	0.114	0.045	0.108	0.113
	(0.093)	(0.060)	(0.095)	(0.095)
sq. experience (predicted, 18+) • female*/100	0.045	0.015	0.058	0.062
	(0.065)	(0.043)	(0.067)	(0.066)
tenure • female*	0.090***	0.057***	0.092***	0.092***
	(0.018)	(0.015)	(0.019)	(0.019)
tenure • male*	-0.006	-0.003	-0.006	-0.006
	(0.026)	(0.016)	(0.026)	(0.026)
square of tenure • female*/100	-0.233***	-0.147***	-0.236***	-0.236***
	(0.063)	(0.045)	(0.064)	(0.064)
square of tenure • male*/100	0.104	0.067	0.110	0.110
	(0.101)	(0.062)	(0.102)	(0.102)
living in Russia from birth *	-0.087	-0.186*	-0.044	-0.044
	(0.142)	(0.108)	(0.145)	(0.145)
Regional Characteristics				
city* *(small villages - reference category)*	0.096	0.798***	-0.029	-0.030
	(0.117)	(0.106)	(0.151)	(0.150)
town* *(small villages - reference category)*	0.040	0.523***	0.028	0.027

	(0.121)	(0.093)	(0.136)	(0.135)
village* *(small villages - reference category)*	0.034	0.220	-0.037	-0.039
	(0.211)	(0.142)	(0.221)	(0.221)
Moscow *		0.288**	0.412***	0.412***
		(0.123)	(0.153)	(0.152)
Moscow region *		0.486***	-0.144	-0.146
		(0.177)	(0.236)	(0.236)
Saint Petersburg *		0.175	0.238	0.239
		(0.170)	(0.215)	(0.215)
Central region *		0.050	0.003	0.003
		(0.097)	(0.126)	(0.126)
South region *		0.192*	0.306**	0.306**
		(0.107)	(0.144)	(0.144)
North-West region *		0.123	0.076	0.075
		(0.132)	(0.186)	(0.186)
Far-East region *		0.233*	0.175	0.174
		(0.134)	(0.183)	(0.184)
Siberia region *		0.146	0.139	0.139
		(0.104)	(0.138)	(0.138)
Household Characteristics				
living in a family *	0.225**	0.141**	0.210**	0.212**
	(0.096)	(0.063)	(0.100)	(0.099)
Health & Sport Activities				
smoking *	-0.251***	-0.171***	-0.274***	-0.273***
	(0.094)	(0.064)	(0.098)	(0.098)
alcohol consumer: often *	-0.468*	-0.255	-0.436	-0.440
	(0.280)	(0.179)	(0.288)	(0.287)
sport activities: during last year *	0.377***	0.233**	0.377***	0.375***
	(0.141)	(0.094)	(0.144)	(0.144)
sport activities: often *	-0.097	-0.093	-0.121	-0.120
	(0.191)	(0.122)	(0.198)	(0.198)
sport activities: never *	-0.145	-0.081	-0.132	-0.133
	(0.133)	(0.086)	(0.136)	(0.136)
Occupational Status of other household members				
maximal occupation status=1 *	-0.264*	-0.170*	-0.272*	-0.271*
	(0.153)	(0.098)	(0.156)	(0.156)
presence of occupational status = 3*	0.130	0.069	0.047	0.049
	(0.162)	(0.101)	(0.170)	(0.169)
maximal occupation status=1 *•	-0.054	-0.032	-0.047	-0.047
• female*	(0.187)	(0.115)	(0.191)	(0.190)
presence of occupational status = 3* •	0.327	0.164	0.272	0.272
• female*	(0.227)	(0.145)	(0.232)	(0.232)
Constant	-1.378***	0.534	-1.669***	-1.662***
	(0.342)	(0.345)	(0.393)	(0.389)

OCCUPATION GROUP 3

Sex				
male * *(female – reference category)*	0.158	-0.172	0.256	0.262
	(0.410)	(0.391)	(0.417)	(0.416)
Individual Characteristics				
3rd educational level * • male*	2.821***	0.929	3.494***	3.515***
	(0.194)	(0.611)	(0.349)	(0.347)
2nd educational level * • male*	0.517***	-0.368	0.872***	0.883***
	(0.185)	(0.303)	(0.256)	(0.255)
3rd educational level * • female*	3.272***	1.355**	3.956***	3.977***
	(0.214)	(0.632)	(0.363)	(0.363)
2nd educational level * • female*	1.214***	0.229	1.562***	1.574***
	(0.197)	(0.352)	(0.254)	(0.255)
experience (predicted, 18+) • male*	0.035	0.049*	0.037	0.034
	(0.031)	(0.029)	(0.031)	(0.031)
experience (predicted, 18+) • female*	0.007	0.009	0.011	0.008
	(0.026)	(0.024)	(0.026)	(0.026)
sq. experience (predicted, 18+) •	-0.116	-0.150*	-0.125	-0.117
• male*/100	(0.086)	(0.080)	(0.086)	(0.086)
sq. experience (predicted, 18+) •	-0.071	-0.085	-0.079	-0.071
• female*/100	(0.071)	(0.066)	(0.072)	(0.072)
tenure • female*	0.122***	0.102***	0.120***	0.120***
	(0.021)	(0.020)	(0.021)	(0.021)
tenure • male*	0.024	0.026	0.025	0.025
	(0.028)	(0.026)	(0.028)	(0.028)
square of tenure • female*/100	-0.245***	-0.194***	-0.233***	-0.232***
	(0.075)	(0.069)	(0.074)	(0.074)

square of tenure • male*/100	-0.012	-0.023	0.009	-0.009
	(0.115)	(0.107)	(0.117)	(0.116)
living in Russia from birth *	-0.183	-0.224*	-0.122	-0.120
	(0.139)	(0.135)	(0.143)	(0.144)
Regional Characteristics				
city* *(small villages - reference category)*	-0.098	0.310**	-0.216	-0.218
	(0.120)	(0.157)	(0.152)	(0.151)
town* *(small villages - reference category)*	-0.117	0.163	-0.166	-0.166
	(0.126)	(0.135)	(0.138)	(0.137)
village* *(small villages - reference category)*	0.004	0.107	-0.044	-0.047
	(0.229)	(0.213)	(0.236)	(0.236)
Moscow *		0.060	0.106	0.106
		(0.154)	(0.165)	(0.165)
Moscow region *		0.138	-0.248	-0.251
		(0.247)	(0.250)	(0.250)
Saint Petersburg *		0.199	0.225	0.226
		(0.204)	(0.209)	(0.208)
Central region *		-0.0524	-0.105	-0.104
		(0.124)	(0.132)	(0.132)
South region *		0.227*	0.279*	0.278*
		(0.138)	(0.149)	(0.149)
North-West region *		0.166	0.119	0.120
		(0.181)	(0.201)	(0.201)
Far-East region *		-0.237	-0.299	-0.300
		(0.184)	(0.194)	(0.194)
Siberia region *		0.230*	0.216	0.216
		(0.133)	(0.142)	(0.142)
Household Characteristics				
living in a family *	0.097	0.067	0.068	0.069
	(0.108)	(0.099)	(0.109)	(0.109)
Health & Sport Activities				
smoking *	-0.213**	-0.183**	-0.221**	-0.219**
	(0.098)	(0.091)	(0.099)	(0.099)
alcohol consumer: often *	-0.046	-0.007	-0.041	-0.048
	(0.257)	(0.241)	(0.259)	(0.259)
sport activities: during last year *	0.289**	0.195	0.276*	0.274*
	(0.145)	(0.133)	(0.146)	(0.146)
sport activities: often *	-0.090	-0.054	-0.083	-0.082
	(0.191)	(0.174)	(0.194)	(0.194)
sport activities: never *	-0.281**	-0.244**	-0.263**	-0.263**
	(0.131)	(0.119)	(0.133)	(0.133)
Occupational Status of other household members				
maximal occupation status=1 *	-0.531***	-0.485***	-0.525***	-0.522***
	(0.160)	(0.152)	(0.161)	(0.161)
presence of occupational status = 3*	0.132	0.089	0.042	0.042
	(0.155)	(0.143)	(0.156)	(0.155)
maximal occupation status=1 * • • female*	0.237	0.237	0.228	0.227
	(0.199)	(0.185)	(0.201)	(0.201)
presence of occupational status = 3* • • female*	0.432*	0.301	0.372	0.372
	(0.226)	(0.204)	(0.227)	(0.226)
Constant	-2.287***	-1.608***	-2.699***	-2.698***
	(0.386)	(0.469)	(0.419)	(0.416)

WAGE EQUATION FOR ALL OCCUPATIONS

Individual Characteristics in ALL OCCUPATIONS				
2nd educational level * • male* • • age_24-35*	0.123	0.840***	0.332***	0.337***
	(0.085)	(0.124)	(0.107)	(0.111)
2nd educational level * • male* • • age_36-55*	-0.027	0.664***	0.178**	0.165*
	(0.054)	(0.099)	(0.086)	(0.086)
2nd educational level * • female* • • age_24-35*	-0.035	0.696***	0.195	0.199
	(0.095)	(0.138)	(0.119)	(0.122)
2nd educational level * • female* • • age_36-55*	-0.099	0.617***	0.131	0.117
	(0.067)	(0.113)	(0.100)	(0.100)
3rd educational level * • male* • • age_24-35*	-0.014	1.325***	0.409*	0.396*
	(0.167)	(0.252)	(0.225)	(0.227)
3rd educational level * • male* • • age_36-55*	-0.145	1.159***	0.281	0.250
	(0.119)	(0.218)	(0.186)	(0.185)
3rd educational level * • female* • • age_24-35*	0.107	1.464***	0.580**	0.563**
	(0.167)	(0.261)	(0.229)	(0.231)
3rd educational level * • female* • • age_36-55*	-0.072	1.256***	0.395*	0.362*
	(0.152)	(0.244)	(0.215)	(0.215)
1st educational level * • male* •	0.170**	0.197**	0.168**	0.189**

• age_24-35*	(0.078)	(0.082)	(0.078)	(0.078)
1st educational level * • female* •	0.139	0.195*	0.144	0.165
• age_24-35*	(0.103)	(0.112)	(0.106)	(0.106)
male*	0.321*	0.574***	0.419**	0.413**
	(0.192)	(0.199)	(0.193)	(0.193)
Individual Characteristics in 2nd OCCUPATIONAL TYPE (additional to all occupations)				
2nd educational level * • male* •	0.204	0.198	0.217	0.215
• age_24-35*	(0.326)	(0.309)	(0.327)	(0.328)
2nd educational level * • male* •	0.068	0.051	0.090	0.089
• age_36-55*	(0.328)	(0.306)	(0.329)	(0.331)
2nd educational level * • female* •	-0.013	-0.052	0.003	-0.001
• age_24-35*	(0.164)	(0.164)	(0.177)	(0.176)
2nd educational level * • female* •	0.117	0.077	0.135	0.133
• age_36-55*	(0.159)	(0.160)	(0.173)	(0.173)
3rd educational level * • male* •	0.027	0.032	0.059	0.055
• age_24-35*	(0.346)	(0.326)	(0.346)	(0.348)
3rd educational level * • male* •	-0.015	0.022	0.022	0.019
• age_36-55*	(0.343)	(0.332)	(0.342)	(0.344)
3rd educational level * • female* •	0.115	0.118	0.108	0.109
• age_24-35*	(0.200)	(0.205)	(0.213)	(0.213)
3rd educational level * • female* •	0.255	0.239	0.239	0.238
• age_36-55*	(0.193)	(0.196)	(0.204)	(0.203)
1st educational level * • male* •	-0.225	-0.241	-0.225	-0.224
• age_24-35*	(0.432)	(0.420)	(0.450)	(0.453)
1st educational level * • female* •	0.032	-0.023	0.052	0.052
• age_24-35*	(0.399)	(0.394)	(0.418)	(0.413)
male*	0.167	0.132	0.150	0.150
	(0.338)	(0.315)	(0.343)	(0.344)
Individual Characteristics in 3rd OCCUPATIONAL TYPE (additional to all occupations)				
2nd educational level * • male* •	-0.020	-0.072	-0.019	-0.022
• age_24-35*	(0.230)	(0.227)	(0.234)	(0.234)
2nd educational level * • male* •	0.073	0.049	0.120	0.120
• age_36-55*	(0.188)	(0.182)	(0.193)	(0.193)
2nd educational level * • female* •	0.183	0.141	0.210	0.207
• age_24-35*	(0.190)	(0.198)	(0.205)	(0.205)
2nd educational level * • female* •	0.302*	0.226	0.330*	0.328*
• age_36-55*	(0.177)	(0.185)	(0.191)	(0.191)
3rd educational level * • male* •	0.152	0.117	0.174	0.170
• age_24-35*	(0.213)	(0.207)	(0.220)	(0.219)
3rd educational level * • male* •	0.363*	0.339*	0.403**	0.399**
• age_36-55*	(0.192)	(0.188)	(0.198)	(0.198)
3rd educational level * • female* •	0.342	0.293	0.357	0.355
• age_24-35*	(0.212)	(0.217)	(0.224)	(0.224)
3rd educational level * • female* •	0.452**	0.389*	0.470**	0.468**
• age_36-55*	(0.204)	(0.210)	(0.218)	(0.218)
1st educational level * • male* •	0.590**	0.590**	0.581**	0.582**
• age_24-35*	(0.274)	(0.289)	(0.292)	(0.292)
1st educational level * • female* •	0.590*	0.444	0.572*	0.566*
• age_24-35*	(0.328)	(0.333)	(0.335)	(0.337)
male*	-0.002	-0.035	0.007	0.007
	(0.221)	(0.224)	(0.235)	(0.234)
Constant	4.626***	3.910***	4.390***	4.384***
	(0.151)	(0.184)	(0.160)	(0.162)
Constant in 2nd Occupation (plus to Constant)	0.408**	0.394*	0.281	0.295
	(0.206)	(0.211)	(0.242)	(0.239)
Constant in 3rd Occupation (plus to Constant)	0.210	0.309	0.070	0.085
	(0.260)	(0.258)	(0.282)	(0.280)
Other Control Variables in Wage Equation				
Individual Characteristics				
experience (predicted, 18+) • male*	0.006	0.003	0.005	0.005
	(0.011)	(0.012)	(0.011)	(0.011)
experience (predicted, 18+) • female*	0.005	0.010	0.008	0.008
	(0.011)	(0.011)	(0.011)	(0.011)
sq. experience (predicted, 18+) •	-0.005	0.003	-0.006	-0.004
• male*/100	(0.026)	(0.027)	(0.026)	(0.025)
sq. experience (predicted, 18+) •	0.001	0.001	-0.007	-0.005
• female*/100	(0.024)	(0.025)	(0.024)	(0.024)
tenure • male*	0.023***	0.022***	0.023***	0.023***
	(0.007)	(0.007)	(0.007)	(0.007)
tenure • female*	0.002	0.002	0.005	0.005
	(0.007)	(0.007)	(0.007)	(0.007)
square of tenure • male*/100	-0.005***	-0.074***	-0.075***	-0.076***
	(0.026)	(0.025)	(0.024)	(0.024)

square of tenure • female*/100	-0.076	0.003	-0.004	-0.003
	(0.024)	(0.022)	(0.022)	(0.022)
living in Russia from birth *	0.007	0.064	0.020	0.019
	(0.042)	(0.050)	(0.043)	(0.043)
Regional Characteristics				
city* *(small villages - reference category)*	0.279***	0.016	0.217***	0.223***
	(0.036)	(0.052)	(0.044)	(0.043)
town* *(small villages - reference category)*	0.159***	0.015	0.133***	0.136***
	(0.034)	(0.043)	(0.037)	(0.037)
Moscow *	0.559***	0.571***	0.586***	0.585***
	(0.051)	(0.059)	(0.054)	(0.054)
Moscow region *	0.709***	0.498***	0.655***	0.660***
	(0.064)	(0.085)	(0.071)	(0.071)
Saint Petersburg *	0.378***	0.413***	0.422***	0.421***
	(0.064)	(0.073)	(0.065)	(0.065)
Central region *	-0.006	-0.009	0.002	0.002
	(0.037)	(0.045)	(0.039)	(0.039)
South region *	0.083**	0.050	0.075*	0.074*
	(0.036)	(0.044)	(0.040)	(0.040)
North-West region *	0.596***	0.510***	0.540***	0.540***
	(0.046)	(0.062)	(0.051)	(0.051)
Far-East region *	0.336***	0.267***	0.298***	0.298***
	(0.052)	(0.065)	(0.058)	(0.058)
Siberia region *	0.081**	0.042	0.064*	0.064*
	(0.035)	(0.044)	(0.038)	(0.038)
Job Characteristics				
state entreprise*	-0.048*	-0.045	-0.048	-0.048
	(0.029)	(0.029)	(0.029)	(0.029)
foreign capital entreprise*	0.208***	0.205***	0.211***	0.211***
	(0.061)	(0.061)	(0.061)	(0.061)
russian capital entreprise*	0.124***	0.118***	0.122***	0.122***
	(0.027)	(0.028)	(0.028)	(0.028)
entrepreneurship*	0.060	0.065	0.058	0.058
	(0.055)	(0.056)	(0.055)	(0.056)
number of hours worked	0.002***	0.002***	0.002***	0.002***
	(0.000)	(0.001)	(0.000)	(0.001)
presence of subordinates *	0.216***	0.213***	0.211***	0.211***
	(0.030)	(0.031)	(0.031)	(0.031)
industrial type: Industrial Resources *	0.348***	0.348***	0.343***	0.344***
	(0.070)	(0.071)	(0.071)	(0.071)
industrial type: Services *	0.109**	0.111**	0.108**	0.108**
	(0.044)	(0.045)	(0.044)	(0.045)
industrial type: Industry *	0.028	0.023	0.029	0.029
	(0.053)	(0.053)	(0.053)	(0.053)
industrial type: Public Services *	-0.194***	-0.201***	-0.194***	-0.194***
	(0.046)	(0.046)	(0.046)	(0.046)
danger working conditions *	0.170***	0.174***	0.171***	0.171***
	(0.036)	(0.036)	(0.036)	(0.036)
not working due to diseases *	-0.036	-0.034	-0.033	-0.033
	(0.047)	(0.047)	(0.047)	(0.047)
sum of subordinates/100	0.026*	0.026*	0.025*	0.025*
	(0.014)	(0.015)	(0.014)	(0.014)
Health & Sport Activities				
disabled worker *	-0.199**	-0.213***	-0.201***	-0.200***
	(0.078)	(0.078)	(0.077)	(0.077)
chronic diseases *	-0.032	-0.031	-0.032	-0.032
	(0.023)	(0.023)	(0.023)	(0.023)
operated in last 12 months *	0.089	0.083	0.074	0.075
	(0.067)	(0.068)	(0.068)	(0.068)

COVARIANCE MATRIX

COEFFICIENTS & STANDARD ERRORS				
σ_00		1.000	1.000	1.000
σ(σ_00)=		-	-	-
σ_10		-0.485***	-0.245***	-0.254***
σ(σ_10)=		(0.130)	(0.076)	(0.075)
σ_11	1.000	1.000	1.000	1.000
σ(σ_11)=	-	-	-	-
σ_20		1.255***	-0.178	-0.181
σ(σ_20)=		(0.099)	(0.148)	(0.146)
σ_21	0.022	-0.513***	0.028	0.032
σ(σ_21)=	(0.165)	(0.171)	(0.172)	(0.172)

σ_22	2.000	2.000	2.000	2.000
σ(σ_22)=	-	-	-	-
σ_30		0.620***	-0.276**	-0.284**
σ(σ_30)=		(0.174)	(0.129)	(0.128)
σ_31	0.231	0.015	0.326*	0.342**
σ(σ_31)=	(0.172)	(0.201)	(0.172)	(0.171)
σ_32	1.000	1.000	1.000	1.000
σ(σ_32)=	-	-	-	-
σ_33	2.000	2.000	2.000	2.000
σ(σ_33)=	-	-	-	-
σ_40		-0.498***	-0.142***	-0.130***
σ(σ_40)=		(0.062)	(0.047)	(0.046)
σ_41	-0.395***	-0.091	-0.275***	-0.276***
σ(σ_41)=	(0.032)	(0.068)	(0.041)	(0.041)
σ_42	-0.306***	-0.680***	-0.193	-0.204
σ(σ_42)=	(0.113)	(0.094)	(0.137)	(0.134)
σ_43	-0.221*	-0.460***	-0.105	-0.117
σ(σ_43)=	(0.133)	(0.129)	(0.140)	(0.139)
σ_44	0.461***	0.632***	0.442***	0.441***
σ(σ_44)=	(0.017)	(0.047)	(0.016)	(0.016)
Observations	4769	4769	4769	4769

*** p<0.01, ** p<0.05, * p<0.1
Standard errors in parentheses

Table 12: Part of estimation results of reduced-form joint model of educational, labour market participation, occupational choices and wages.

	(1)	(2)	(3)	(4)
(1): Education Equation	**–**	**+ (IV: 1)**	**+ (IV: 2)**	**+ (IV: 1&2)**
(2): Employment Equation	**+**	**+**	**+**	**+**
(3): Occupational Choice Equation	**+**	**+**	**+**	**+**
(4): Wage Equation	**+**	**+**	**+**	**+**
WAGE EQUATION FOR ALL OCCUPATIONS				
Educational Characteristics in 1st OCCUPATIONAL TYPE (ALL OCCUPATIONS)				
1st educational level * • male* • age_24-35*	**0.170****	**0.197****	**0.168****	**0.189****
1st educational level * • female* • age_24-35*	0.139	**0.195***	0.144	0.165
2nd educational level * • male* • age_24-35*	0.123	**0.840*****	**0.332*****	**0.337*****
2nd educational level * • male* • age_36-55*	-0.027	**0.664*****	**0.178****	**0.165***
2nd educational level * • female* • age_24-35*	-0.035	**0.696*****	0.195	0.199
2nd educational level * • female* • age_36-55*	-0.099	**0.617*****	0.131	0.117
3rd educational level * • male* • age_24-35*	-0.014	**1.325*****	**0.409***	**0.396***
3rd educational level * • male* • age_36-55*	-0.145	**1.159*****	0.281	0.250
3rd educational level * • female* • age_24-35*	0.107	**1.464*****	**0.580****	**0.563****
3rd educational level * • female* • age_36-55*	-0.072	**1.256*****	**0.395***	**0.362***
male*	**0.321***	**0.574*****	**0.419****	**0.413****
Constant	**4.626*****	**3.910*****	**4.390*****	**4.384*****
Educational Characteristics in 2nd OCCUPATIONAL TYPE vs 1st OCCUPATIONAL TYPE (additional to 'all occupations')				
1st educational level * • male* • age_24-35*	-0.225	-0.241	-0.225	-0.224
1st educational level * • female* • age_24-35*	0.032	-0.023	0.052	0.052
2nd educational level * • male* • age_24-35*	0.204	0.198	0.217	0.215
2nd educational level * • male* • age_36-55*	0.068	0.051	0.090	0.089
2nd educational level * • female* • age_24-35*	-0.013	-0.052	0.003	-0.001
2nd educational level * • female* • age_36-55*	0.117	0.077	0.135	0.133
3rd educational level * • male* • age_24-35*	0.027	0.032	0.059	0.055
3rd educational level * • male* • age_36-55*	-0.015	0.022	0.022	0.019
3rd educational level * • female* • age_24-35*	0.115	0.118	0.108	0.109
3rd educational level * • female* • age_36-55*	0.255	0.239	0.239	0.238
male*	0.167	0.132	0.150	0.150
Constant in 2nd Occupation (plus to Constant)	**0.408****	**0.394***	0.281	0.295
Educational Characteristics in 3rd OCCUPATIONAL TYPE vs 1st OCCUPATIONAL TYPE (additional to 'all occupations')				

1st educational level * • male* • age_24-35*	**0.590****	**0.590****	**0.581****	**0.582****
1st educational level * • female* • age_24-35*	**0.590***	0.444	**0.572***	**0.566***
2nd educational level * • male* • age_24-35*	-0.020	-0.072	-0.019	-0.022
2nd educational level * • male* • age_36-55*	0.073	0.049	0.120	0.120
2nd educational level * • female* • age_24-35*	0.183	0.141	0.210	0.207
2nd educational level * • female* • age_36-55*	**0.302***	0.226	**0.330***	**0.328***
3rd educational level * • male* • age_24-35*	0.152	0.117	0.174	0.170
3rd educational level * • male* • age_36-55*	**0.363***	**0.339***	**0.403****	**0.399****
3rd educational level * • female* • age_24-35*	0.342	0.293	0.357	0.355
3rd educational level * • female* • age_36-55*	**0.452****	**0.389***	**0.470****	**0.468****
male*	-0.002	-0.035	0.007	0.007
Constant in 3rd Occupation (plus to Constant)	0.210	0.309	0.070	0.085
Observations	4769			

* significant at 10%; ** significant at 5%; *** significant at 1%

Table 13: Estimated Covariance Matrix for Random Components.

	(1)	(2)	(3)	(4)
(1): Education Equation	**–**	**+ (IV: 1)**	**+ (IV: 2)**	**+ (IV: 1&2)**
(2): Employment Equation	**+**	**+**	**+**	**+**
(3): Occupational Choice Equation	**+**	**+**	**+**	**+**
(4): Wage Equation	**+**	**+**	**+**	**+**
	COVARIANCE MATRIX			
σ_11		1.000	1.000	1.000
σ(σ_11)=		-	-	-
σ_21		-0.485***	-0.245***	-0.254***
σ(σ_21)=		(0.130)	(0.076)	(0.075)
σ_22	1.000	1.000	1.000	1.000
σ(σ_22)=	-	-	-	-
σ_31		1.255***	-0.178	-0.181
σ(σ_31)=		(0.099)	(0.148)	(0.146)
σ_32	0.022	-0.513***	0.028	0.032
σ(σ_32)=	(0.165)	(0.171)	(0.172)	(0.172)
σ_33	2.000	2.000	2.000	2.000
σ(σ_33)=	-	-	-	-
σ_41		0.620***	-0.276**	-0.284**
σ(σ_41)=		(0.174)	(0.129)	(0.128)
σ_42	0.231	0.015	0.326*	0.342**
σ(σ_42)=	(0.172)	(0.201)	(0.172)	(0.171)
σ_43	1.000	1.000	1.000	1.000
σ(σ_43)=	-	-	-	-
σ_44	2.000	2.000	2.000	2.000
σ(σ_44)=	-	-	-	-
σ_51		-0.498***	-0.142***	-0.130***
σ(σ_51)=		(0.062)	(0.047)	(0.046)
σ_52	-0.395***	-0.091	-0.275***	-0.276***
σ(σ_52)=	(0.032)	(0.068)	(0.041)	(0.041)
σ_53	-0.306***	-0.680***	-0.193	-0.204
σ(σ_53)=	(0.113)	(0.094)	(0.137)	(0.134)
σ_54	-0.221*	-0.460***	-0.105	-0.117
σ(σ_54)=	(0.133)	(0.129)	(0.140)	(0.139)
σ_55	0.461***	0.632***	0.442***	0.441***
σ(σ_55)=	(0.017)	(0.047)	(0.016)	(0.016)
Observations	4769			

Standard errors in parentheses

* significant at 10%; ** significant at 5%; *** significant at 1%

Table 14. Model Fit: Education Choice, Employment, Occupational Choice.

	Predicted Probabilities, %	**Observed Probabilities, %**
Educational Choice		

All Population		
Secondary Education	**29.470**	**29.545**
1st Level Tertiary Education	**48.548**	**48.543**
2nd Level Tertiary Education	**21.982**	**21.912**
By Educational Types:		
Secondary Education		
Secondary Education	**37.454**	**-**
1st Level Tertiary Education		
1st Level Tertiary Education	**49.362**	**-**
2nd Level Tertiary Education		
2nd Level Tertiary Education	**31.482**	**-**

Employment		
All Population		
Employed	**73.592**	**73.600**
Non-Employed	**26.408**	**26.400**
Employed Population		
Employed	**78.920**	**-**
By Educational Types		
Secondary Education		
Employed	**60.089**	**59.972**
1st Level Tertiary Education		
Employed	**76.404**	**76.501**
2nd Level Tertiary Education		
Employed	**85.571**	**85.550**

	Predicted Probabilities, %	**Observed Probabilities, %**
Occupational Choice		
By Educational Types:		
Secondary Education		
Occupation 1	**89.753**	**89.822**
Occupation 2	**6.367**	**6.391**
Occupation 3	**3.880**	**3.787**
1st Level Tertiary Education		
Occupation 1	**68.127**	**68.154**
Occupation 2	**19.951**	**19.932**
Occupation 3	**11.922**	**11.914**
2nd Level Tertiary Education		
Occupation 1	**18.819**	**18.680**
Occupation 2	**24.172**	**24.161**
Occupation 3	**57.009**	**57.159**
By Occupational Types:		
Occupation 1		
Occupation 1 if Education==1	**90.200**	**-**
Occupation 1 if Education==2	**73.110**	**-**
Occupation 1 if Education==3	**24.570**	**-**
Occupation 2		
Occupation 2 if Education==1	**9.872**	**-**
Occupation 2 if Education==2	**26.802**	**-**
Occupation 2 if Education==3	**26.276**	**-**
Occupation 3		
Occupation 3 if Education==1	**6.164**	**-**
Occupation 3 if Education==2	**17.732**	**-**
Occupation 3 if Education==3	**60.539**	**-**